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JOURNAL OF THE BOSTON SOCIETY OF CIVIL ENGINEERS

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A SUGGESTION FOR ENGINEERING EDUCATION

PRESIDENTIAL ADDRESS BY LEWIS E. MOORE,* BOSTON SOCIETY OF
CIVIL ENGINEERS, MARCH 18, 1931

It is a requirement of the Constitution of the Boston Society of Civil Engineers that the retiring President shall deliver an address at the annual meeting. This is an onerous, if not ornery, duty which causes a feeling of dread in the minds of all the occupants of the chair during the period of their incumbency.

At the annual meeting this feeling leaves the President and is transferred to the members present, whose usual mental attitude is dread that they may disgrace themselves by unbecoming and unavoidable somnolence during the exercises which their New England consciences constrain them to attend.

Various presidents endeavor to meet this situation in divers ways. Some endeavor to instruct in some subject which they think the members ought to know more about, entirely forgetting that five o'clock in the afternoon is no time of day to either impart or imbibe instruction. Some try to write in general terms about almost anything that they hope may be favorably regarded by an indulgent audience. Still others treat the rostrum as a confessional, and relieve their minds of some particular burden which they have been carrying for years, without any regard to the wishes or convenience of those compelled by courtesy to listen. The one who is now addressing you belongs to the latter class.

A piece of machinery which is operating smoothly, or a corporation which regularly pays its dividends, generally has no attention paid to it until something goes wrong.

* Consulting Engineer, 73 Tremont Street, Boston, Mass.

Judging from the attention lately paid to the subject of engineering education, something must be seriously wrong with it. Generally speaking, it seems to me that the results, if they are judged by the place which the engineer takes in the community, are not satisfactory.

DEVELOPMENT OF ENGINEERING EDUCATION

To understand the reasons for this, one must go back and trace the development of engineering education from its beginning.

The first engineer was undoubtedly a military engineer, and he performed all the functions required of engineers of his day, except those that were performed by architects. His work was all based on rule-of-thumb, backed by good judgment.

With the close of the Middle Ages, when war ceased to be a major industry, there was more and more demand for engineering work to be done for civil purposes. At first this probably was done by the military engineers who were out of a job. After a time the engineering work in civil life became sufficiently voluminous so that those who were performing it dropped entirely any idea of military duties, and became, and named themselves, Civil Engineers.

Without going too much into detail, at first an engineer was an engineer, and was assumed to be, and usually was, capable of performing all duties in all lines. With the commencement of the industrialization of civilization, the lines followed by the engineer became more varied, and resulted in the forming of a group called Mechanical Engineers. With the advances made in electricity, the electrical engineer group split off from the mechanical engineers.

At the time I entered college, about thirty-five years ago, there were practically only three engineering courses taught, namely, civil, mechanical and electrical. Since then the sanitary engineer, the chemical engineer, etc., have all come into being.

ENGINEERING SPECIALTIES

I saw some figures the other day which stated that there are now something like seventy-three (or perhaps it was ninety-three) different engineering specialties taught in the engineering colleges. Let us consider, for a minute, what that means to the young man who takes up the engineering profession, very often because his family mistakenly thinks that his remuneration will be large, or, more rarely, because he has a decided inclination toward that vocation. What he will do when he graduates depends upon what opportunities are then open. How

absurd it is, purely from the standpoint of the mathematical theory of probability, to expect him to select in advance, among the seventy-three specialties taught, the one which will be open to him when he is ready to go to work.

The growth of these specialties, of course, can be traced to methods of administration and to the manner in which the courses in engineering colleges were laid out. When engineering courses originated it was possible to teach all the fundamentals as far as they were then known, and to cover as well a very large proportion of the field of problems which were met in actual practice. As the students increased numerically, and the knowledge of the principles of engineering broadened, the teacher who handled several subjects gave way to the specialist who handled only one or two. Certain of these specialists gained considerable prominence for themselves and their schools by the publication of the results of their individual research. This led to the idea that the engineering professor must first be a research man, and the necessity of his possessing ability as a teacher was for many years entirely lost sight of in many places in this passion for research. It made no difference what the research was, so long as it was research, and it made no difference how poorly the research man might teach as compared to the real teacher. The former was always given the preference when it came to a question of advancement. Within my knowledge, in a western university, when it came to a choice between advancing one of two men to be the head of a department of romance languages, the one who had written the most, measured literally by pages, was promoted, although his equipment for an administrator and the value of his writings as viewed by contemporaries whose opinion was of worth were both poorer than the other man's. The presidents of colleges said to their professors: "You must write to be advanced." The condition that has resulted was foreseen many, many years ago when the writer of Ecclesiastes penned these lines: "Of the making of books there is no end, and much study is a weariness to the flesh."

I, myself, taught in three different institutions, and in only one of them was I asked whether or not I could teach, and in only one of them (not the same one) was there any real supervision over my performance of my duties as a teacher. Given conditions such as these, combined with ambition for personal advancement on the part of the individual teacher, it is not at all difficult to see that the natural result has been the growth of the absurd number of specialties that are now taught.

This committee and that committee, this society and that society, have investigated engineering education, and, like all American investi-

gations of any kind, whether it be of education, crime, religion, the price of coal, or the consolidation of railroads, the net results have been a very nice report which may be printed somewhere and is then relegated immediately to oblivion, either through the natural operation of insufficiently weighed economic factors, or, more commonly, through general indifference.

The result of all this is that a student is turned out into the world, and in his youth, and the excusable ignorance that goes therewith, thinks that the world will receive him with open arms and give him a job in his specialty. As a matter of fact, he has only one chance in seventy-three of hitting the specialty which he has prepared for in good faith and with excusable confidence.

SEARCH FOR SCHOOL TO MEET IDEALS FOR TRAINING

I have never believed in destructive criticism. As a rule, if I cannot suggest something that seems to me better, I try to keep still. In this case, however, I have something to offer, and, to forestall a certain type of criticism, let me say that I started to try out on my own son a course similar to the engineering course which I am about to outline to you. It naturally could not be the same, because I had to select the subjects which came nearest to fitting my ideas from the available curriculum. In the course I shall suggest later I have been able to give myself free rein. For the purpose I picked out Cornell University because it had not only engineering, but also departments of philosophy and literature and arts, as well as an excellent reputation. I took the trouble to visit the institution myself and to interview some of the professors, and received wonderful co-operation from them in the arrangement of my son's courses. The outcome was that an unlooked for opportunity to follow his heart's desire and enter the United States Naval Academy cut his attendance at Cornell down to only one term, so that I cannot report final results.

I can say that I have had ten and one-half years' experience as a teacher in three of the largest universities in the country, and I never saw a boy develop mentally as rapidly as my son did with the type of general fundamental education which was fed to him for only one-half a year; and let me say, lest I be accused of bragging about my own boy, that I fully realize that all our own ducks are swans, and I have endeavored to discount my natural prejudices in estimating the results. I, at least, think I have developed the fact that I was perfectly willing to try the experiment on my own.

SUGGESTED COURSE FOR STUDENTS IN ENGINEERING

FIRST YEAR			
	Hours per Week		Hours per Week
Logic	2	English	4
English	4	Mathematics	5
Mathematics	5	Physics	5
Descriptive Geometry	2	Chemistry	4
Physics	5	Practical	2
Practical	2		
SECOND YEAR			
Psychology	2	English	3
English	3	Physics	5
Physics	5	Economics	4
Mathematics	5	Materials of Engineering	3
Materials of Engineering	3	Strength of Materials	3
Practical	2	Practical	2
THIRD YEAR			
Language	3	Language	3
Physics	5	Physics	5
Chemistry	5	Chemistry	5
Strength of Materials	3	Strength of Materials	3
Bacteriology	2	Bacteriology	2
Practical	2	Practical	2
FOURTH YEAR			
Language	3	Language	3
Physics	6	Physics	6
Chemistry	6	Chemistry	6
Professional Lectures	3	Professional Lectures	3
Practical	2	Practical	2

The table shows a four-year engineering course laid out in accordance with my ideas. I have limited it to four years because that seems to be the practical limitation with which college courses are surrounded at present.

Looking it over, it will be seen at once that the only specialties which are mentioned in it are covered under the heading of "Practical," to which two hours each week are devoted throughout the four years.

To begin at the beginning, it will be noticed that formal logic is included in the first term's work. This is done because it seems desir-

able to know something about a machine before attempting to run it; and yet the vast majority of students are put through from kindergarten to postgraduate course, inclusive, without being taught anything about brain processes or the mechanism of the brain, or, in other words, without ever being taught how to think. They are expected to know how to run the mental machine without knowing anything about it. It would be just as sensible to put a Hottentot, who had never seen any machinery, in front of the newest form of power loom and to tell him to turn out enough *moire antique* for a woman's dress.

I cannot alter the processes of the lower schools, and probably this address of mine will not alter the processes of the higher schools, either, but at any rate, I can tell what I conceive to be the truth, and free my mind of a burden which has been resting on it for lo! these many years.

I have therefore put logic the first thing, and have called it by its right name, because I think it is sometimes advantageous to have impressed upon one exactly what one is studying. In other words, I do not think logic should be fed under the guise of English, or of any other study. Educationally speaking, I do not think it wise to disguise castor oil as candy.

You will note, also, a concession to present methods in the inclusion of descriptive geometry in the first term; and this subject, I may say, should be taught as a branch of mathematics, which it is, and not as a branch of engineering drawing, as is almost universally done.

You will note that four hours a week are given to English the first year and three hours the second, and that mathematics are given five hours a week for one and one-half years.

You will note that a course in psychology is included in the first term of the second year. Logic and psychology are in part intended to offset the tendency of mathematics to produce the impression in the mind of the student that if he can only get a formula and put in some quantities from somewhere, or anywhere, he is bound to get the correct answer. In other words, they are partially intended to offset the rigid formalism of the operation of the mathematical machine.

NATURAL PHILOSOPHY AND THE SCIENCES

You will note that physics, or, as I prefer to call it in this connection by its old name, natural philosophy, is carried throughout the course five hours a week for three years, and six hours a week during the fourth year. Physics, as I have used it, covers all that is usually given in college courses, but carries each branch farther. It includes applied

mechanics, heat carried to the extent of developing the fundamentals of thermodynamics sufficiently to give the student an intelligent idea of it, and similarly the fundamentals of electricity, and hydraulics developed with regard to other fluids, as well as water. It may be carried on, of course, into physical chemistry, as far as may seem wise and needful.

Chemistry occurs in the second term of the first year, this being the so-called inorganic chemistry. Organic and other chemistry commences the first term of the third year, and is carried through to the end, including such subjects as combustion, etc. It should also include some instruction in what I might call, for the want of a better term, large scale chemistry. Much may be taught, of course, by means of a test tube and a few beakers, but this does not serve to give an adequate conception of how chemical processes are conducted on a large scale in an oil or sugar refinery.

Courses in the materials of engineering and strength of materials are included in the second year, and it should be noted that these courses should include not only the ordinary materials, — wood, steel, stone and concrete, — but alloys as well. Probably a subject such as alloys should be taken up from one viewpoint in the course in materials in engineering, and from another viewpoint in the course in chemistry.

Bacteriology also has found a place largely because of its importance in sanitation.

Language should cover a working knowledge of two foreign languages.

GENERAL CONSIDERATIONS

Some will criticise the courses outlined above by saying that I have simply included the old subjects under different names. I have been obliged to refer to them by well-known names in order to indicate where the fundamental principles underlying the practical applications may be found. It is the intention, however, that these subjects shall be presented from the purely philosophical standpoint, so that the underlying principles of science will be thoroughly understood. Only sufficient exercises in problem work should be given to enable an intelligent idea to be formed of the proper magnitude of the result.

I would call your attention again to the heading "Practical," which is given two hours per week throughout the course. This is intended to be used either for lectures or seminars, which are to illustrate some of the practical applications of the subjects which the student is studying at the time from the philosophical standpoint. If desired, this time

can be used, in the first year only, for shop work and drawing. Professional lectures, to which time is given in the last year, are intended to supplement and add to the practical time by illustrating the problems of all sorts which are met with in practice and the methods of attacking them. Incidentally, two or three of them might well be used to give the student an idea of his relative importance in his first job.

The Civil Engineer will note the total absence of surveying, of railroads, and of highway engineering as such. It is intended that the practical hours and the course of professional lectures shall give an idea of how to attack practical problems in these and other subjects with the scientific knowledge previously gained in the study of the general subjects. To put it a little differently, the practical hours and professional lectures are intended to show the bearing of the theoretical knowledge with reference to the practical result sought.

A TASK REQUIRING COURAGE

I realize fully that the division of time between the different subjects may not be ideal. It would be very strange if I, or any other one man, could sit down and lay out a course of this nature and balance its parts properly, but at any rate, it is a suggestion which might be made fruitful. The inertia of those who are now teaching engineering must be overcome, and the courage of those in charge of technical institutions must be sufficiently great to admit that they have been in error in the past, and that they have been turning out men who are too often narrow technicians instead of scientifically educated gentlemen capable of taking hold of any of the branches of applied science and by study specializing in them without undue lost motion and with a fair degree of success. Such a change can hardly be made gradually. It would require an institution with sufficient vision and courage to make a sweeping revision of its curriculum, and perhaps of its teaching force.

To institute and administer such a course and to keep the professors from teaching specialties, and, above all, to select professors who can teach and whose first interest is in teaching and developing the minds of the students, will be, in the words of Stevenson, "A task for all that a man hath of courage and fortitude."

PREFERRED SPEEDS

BY CLARENCE P. TAYLOR*

(Presented at a meeting of the Highway Section of the Boston Society of Civil Engineers February 25, 1931)

THE object of this paper is not to attempt to formulate new speed laws, although speed regulations are discussed, but rather to present some of the fundamental data which are available for use in this connection, and at the same time to offer, as nature's contribution, an old but all-embracing law governing the efficiency of speed as a means for saving time. There are enormous possibilities for making the most out of speed by the practical application of this very old law. Moreover, it puts an entirely new aspect on the problem of speed, for it decrees that, given any particular distance to be traversed, the saving in time gained by increasing the rate of speed from a relatively low one to one somewhat higher is very large, while for the same amount of increase at higher speeds the amount of time saved is almost negligible. It is possible, therefore, to choose a point beyond which any further increase in speed will not yield savings in time commensurate with the speed required. Such a point for the purposes of this paper is termed preferred speed.

SPEED LAWS

Broach the subject of automobile speed to any group of persons and you will find that there are as many different views as there are persons. It makes substantially no difference whether the group be composed entirely of automobile drivers, judges, police officers, traffic experts or laymen — no two people seem to be in accord, and the subject always seems to be in controversy. A divergence of views on speed legislation now exists between the various states.

Generally speaking, there are three fundamental schools of thought on what may be termed the proper approach to the subject of speed regulation.

Fixed Limits. — All of the earliest forms of legislation absolutely defined the limits of speed and declared it to be unlawful to exceed them. Texas, West Virginia, Oklahoma and Oregon are the only states which still have this form of legislation. Proponents of the fixed limit

* Traffic Engineer, Massachusetts Department of Public Works.

type of law have argued that its advantages are that it provides motorists with a gauge of what is a safe speed, and furnishes officers and the courts with a concrete test for judging a violation.

Reasonable and Proper Speeds. — Many people recognized early the futility of trying to define the proper speeds for all conditions, and felt that arbitrary limits were unjust. They advocated a very general rule which was designed to make it unlawful to drive a car at a greater rate of speed than is reasonable and proper. Connecticut and Vermont are the only states which have this type of speed regulation.

Clear Space Ahead. — A few deep thinkers have for quite some time now proposed that inasmuch as the purpose of all speed regulation is to prevent accidents, operators should be compelled to drive their cars at all times at or below such a speed as will permit them to stop within the clear space ahead. This means that if two cars approach in cross directions from behind an obstruction to view and collide, one or both drivers could be prosecuted because one or the other, or both, failed to govern their speed so as to stop before reaching the danger point. No states have used this idea exclusively as their law.

There are two combinations of these types of approaches which are now used by the majority of states, and a third combination which is recommended by the National Conference on Street and Highway Safety for adoption by all.

Reasonable and Proper Law with Fixed Limits. — Some thirteen states have combined the "reasonable and proper" requirement with certain definite maximum limits. Fixed maximum limits sanction all speeds below those designated. Hence, without a "reasonable and proper" clause many provoking instances of driving faster than permitted by existing conditions might go unprosecuted because the speeds were below the maximums set by law. The "reasonable and proper" clause closes this loophole.

Prima Facie Law. — Those who were not satisfied with the fixed limit, or the "reasonable and proper," or the combination of the two types of speed legislation, promulgated a more advanced form of regulation. Their recommendation was that following a "reasonable and proper" clause certain speed limits should be set up which could be exceeded with impunity, providing one did not get arrested, and providing, further, that if he did get arrested he was able to convince the court that the circumstances were such that the alleged speed was perfectly safe. In this type of law the term "prima facie evidence" is generally used.

This term means that the defendant is presumed guilty as soon as evidence has been introduced showing that the limits established by

law have been exceeded. After that he must be found guilty unless he is able to prove that the speed under the circumstances was really safe.

The principal objection to this type of regulation is that it is not generally understood. To all intents and purposes it may be generally said to operate as though it were a fixed limit law. Massachusetts, California and New Jersey are a few of the many states using this very popular type of regulation.

Uniform Vehicle Speed Law. — The National Conference on Street and Highway Safety now advocates the adoption of a uniform speed

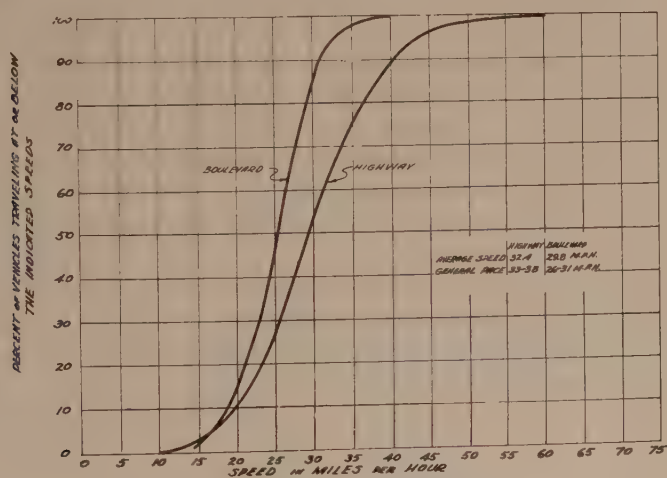


FIG. 1. — HIGHWAY AND BOULEVARD SPEED CHARACTERISTICS

law which sets up certain definite speed limits, the exceeding of which is prima facie evidence of driving faster than is reasonable and proper. In addition, it requires operators always to govern their speed according to the amount of clear space ahead. As yet this regulation has not been adopted by any state.

Such, therefore, are some of the approaches and attempts to solve the speed problem by legislation. Many of the states use various combinations of the different types of regulations.

ACTUAL SPEEDS OF TRAFFIC

Speed tests have been made under similar highway conditions in Maryland and in New Jersey, where a *prima facie* law for 40 miles per hour was in effect, and in Massachusetts, where a 20 miles per hour *prima facie* law was in effect. The results show that the speed chosen by the majority of drivers was substantially the same, — about 35 miles per hour. In these instances the state laws apparently did not influence the speed of motor vehicles, and it is very doubtful if legal restrictions in themselves exert anywhere any material influence on speed.

Table I lists the per cent of automobiles which were found to be traveling at or below the listed speeds on a state highway. Table II shows the same data for travel on a boulevard. From these data characteristic speed curves have been drawn to show speed characteristics for each type of road. The curve on Fig. 1 for boulevard conditions rises more steeply than that for highway conditions. This means that, as a group, the vehicles using boulevards travel more closely to their average speed, while the speeds used on highways are dispersed somewhat.

The average speed of boulevard traffic is 2.6 miles per hour slower than highway traffic, while the general pace is 7 miles per hour less. (See Fig. 1.) The average speeds are the arithmetical average determined from the speed check data.

TABLE I. — SPEED TESTS: HIGHWAY CONDITIONS

CITY OR TOWN IN MASSACHUSETTS	Auto Route No.	Grade	CROSS ROAD		SPEED IN MILES PER HOUR									
			Proximity	Signalized	Per Cent of Automobiles Traveling at or below the Speed Indicated									
					10	15	20	25	30	35	40	45	50	
1. Danvers	1	Slight	300' south	Yes	.0+	.7	3.4	9.8	44.2	72.5	85.5	94.8	98.2	
2. Danvers	1	Slight	300' north	Yes	.0+	2.4	6.3	16.0	42.8	69.0	81.1	92.3	96.4	
3. Danvers	1	Slight	Across	Yes	—	—	3.3	7.8	25.6	54.4	86.6	100.0	—	
4. Swansea	6	Slight	Across	No	.8	12.3	24.7	41.3	76.5	96.7	100.0	—	—	
5. Saugus	1	Level	None within 1000'		—	1.6	3.1	22.0	42.5	63.8	81.2	90.5	95.3	
6. Ipswich	1	Level	None within 1000'		—	—	8.2	21.9	37.0	60.2	86.3	97.2	97.2	
7. Hanover	3	Level	100' away	No	—	2.8	16.5	37.6	77.2	89.0	99.0	100.0	—	
8. Sandwich	6	Level	100' away	No	—	4.6	24.2	52.8	74.7	95.5	95.5	100.0	—	
9. Franklin	140	Level	None within 1,000'		.4	2.9	8.3	24.1	43.2	71.0	83.8	93.0	100.0	
10. Franklin	140	Level	100' away	No	—	.9	6.1	33.1	64.4	84.5	93.0	98.1	99.1	
Average					.0+	2.8	10.4	26.7	52.8	75.7	89.2	96.6	98.6	

NOTE. — All tests were made by the stop watch method. Cars were chosen at random from either direction. Roads well traveled but not congested. Roadways straight and of ample width. Surface of pavements smooth, hard and dry.

TABLE I.—SPEED TESTS: HIGHWAY CONDITIONS—*Concluded*

CITY OR TOWN IN MASSACHUSETTS	Auto Route No.	Grade	CROSS ROAD		SPEED IN MILES PER HOUR					Average	General Pace	Number of Ob- serva- tions
					55	60	65	70	75			
			Proximity	Signalized	Per Cent of Automobiles Traveling at or below the Speeds Indicated							
1. Danvers	1	Slight	300' south	Yes	99.0	99.8	99.9	100.0	—	34.6	35-40	1,773
2. Danvers	1	Slight	300' north	Yes	98.0	99.0	99.6	99.9	100.0	34.8	35-40	1,054
3. Danvers	1	Slight	Across	Yes	—	—	—	—	—	36.1	35-40	90
4. Swansea	6	Slight	Across	No	—	—	—	—	—	27.4	30-35	247
5. Saugus	1	Level	None within 1,000'	1,000'	99.2	100.0	—	—	—	35.0	35-40	127
6. Ipswich	1	Level	None within 1,000'	1,000'	100.0	—	—	—	—	34.6	35-40	73
7. Hanover	3	Level	100' away	No	—	—	—	—	—	28.9	30-35	109
8. Sandwich	6	Level	100' away	No	—	—	—	—	—	27.6	30-35	87
9. Franklin	140	Level	None within 1,000'	1,000'	—	—	—	—	—	33.6	35-40	241
10. Franklin	140	Level	100' away	No	99.1	100.0	—	—	—	31.1	30-35	115
Average	.	.	.	.	99.6	99.9	99.9	100.0	100.0	32.4	33-38	391.6

NOTE.—All tests were made by the stop watch method. Cars were chosen at random from either direction. Roads well traveled but not congested. Roadways straight and of ample width. Surface of pavements smooth, hard and dry.

TABLE II. — SPEED TESTS: BOULEVARD CONDITIONS

CITY IN MASSACHUSETTS	Boulevard	Cross Road Signal- ized	SPEED IN MILES PER HOUR							Per Cent of Automobiles Traveling at or below the Speeds Indicated
			10	15	20	25	30	35	40	
1. Boston .	Old Colony Boulevard .	No	—	5.2	18.3	41.8	74.5	94.5	99.9	
2. Somerville .	Alewife Brook Parkway .	No	—	—	4.0	20.5	53.0	96.0	100.0	
3. Cambridge .	Memorial Drive .	No	—	—	9.0	28.0	72.0	97.0	100.0	
4. Cambridge .	Memorial Drive .	No	—	—	10.0	61.0	98.0	100.0	—	
5. Boston .	Soldiers' Field Road .	No	—	—	3.9	24.5	78.4	98.0	100.0	
6. Cambridge .	Massachusetts Avenue .	No	—	—	2.0	28.0	88.0	100.0	—	
7. Boston .	Beacon and Bay State .	No	—	7.0	47.0	70.8	97.5	100.0	—	
8. Revere .	Revere Beach Parkway .	Yes	—	1.0	32.0	80.0	97.0	100.0	—	
9. Everett .	Revere Beach Parkway .	Yes	—	—	18.0	76.0	100.0	—	—	
10. Somerville .	Northern Artery .	Yes	—	—	2.0	27.0	78.0	100.0	—	
Average .		.	—	1.3	14.6	45.8	83.6	98.6	100.0	

NOTE. — All tests were made within 100 feet of a cross road. Stop watch method used. Cars were chosen at random from either direction. Roads well traveled but not congested. Roadways straight and of ample width. Surface of pavements smooth, hard, dry and level.

TABLE II. — SPEED TESTS: BOULEVARD CONDITIONS — *Concluded*

CITY IN MASSACHUSETTS	Boulevard	Cross Road Signalized	SPEED IN MILES PER HOUR				Average	General Pace	Number of Observations
			45	50	55	60			
			Per Cent of Automobiles Traveling at or below the Speeds Indicated						
1. Boston	Old Colony Boulevard	No	100	—	—	—	28.3	30-35	443
2. Somerville	Alewife Brook Parkway	No	—	—	—	—	31.4	30-35	200
3. Cambridge	Memorial Drive	No	—	—	—	—	29.7	30-35	100
4. Cambridge	Memorial Drive	No	—	—	—	—	26.6	25-30	100
5. Boston	Soldiers' Field Road	No	—	—	—	—	29.8	30	102
6. Cambridge	Massachusetts Avenue	No	—	—	—	—	29.1	25-30	100
7. Boston	Beacon and Bay State	No	—	—	—	—	24.5	25	213
8. Revere	Revere Beach Parkway	Yes	—	—	—	—	25.1	20-25	100
9. Everett	Revere Beach Parkway	Yes	—	—	—	—	25.3	25	100
10. Somerville	Northern Artery	Yes	—	—	—	—	29.6	30	100
Average			100	100	100	100	27.9	26-31	155.8

NOTE. — All tests were made within 100 feet of a cross road. Stop watch method used. Cars were chosen at random from either direction. Roads well traveled but not congested. Roadways straight and of ample width. Surface of pavements smooth, hard, dry and level.

SPEED AND FATIGUE.

No scientific data seem available as to the effects on the mind and body caused by driving at different rates of speed under the same conditions. From personal experience, as far as speed is concerned, there seems to be a happy medium. Very slow rates of speed make one impatient. Excessive rates of speed tend to cause a heavy drain on the nervous system. This is due, probably, to the rapidity with which objects are passed, the close attention required, the tenseness of the muscles, and the noise from the engine and car. It is believed that for

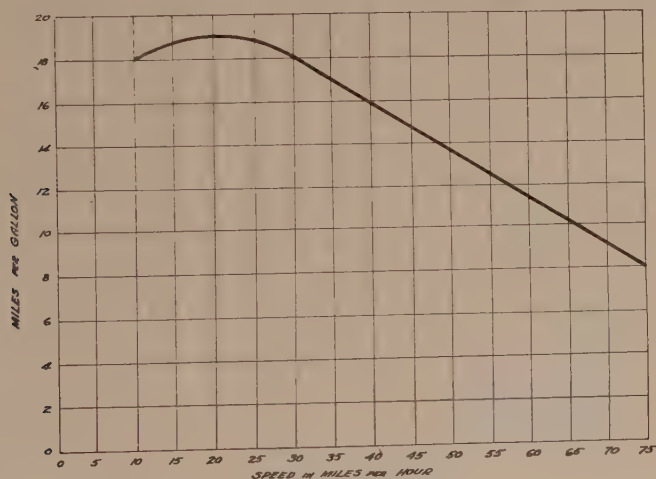


FIG. 2. — FUEL CONSUMPTION *v.* SPEED
(CHARACTERISTIC CURVE FOR AUTOMOBILES)

a given set of conditions there are natural rates of speed beyond and below which operators prefer not to go.

This seems to be borne out by the speed test data collected. It was quite evident that the main body of motorists when given perfect driving conditions on an open highway prefer to drive between 35 and 40 miles per hour, and on boulevards, under equally good conditions, the general pace tends to become 30 to 35 miles per hour.

SPEED AND COST OF OPERATION.

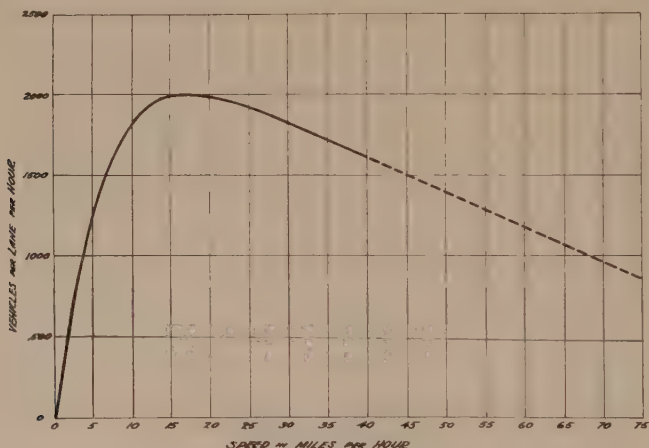
Seldom, when hurrying home over the highway, is any thought given to the extra cost involved in going so fast. Note in Fig. 2 how rapidly the miles per gallon drops as the speed increases. At 70 miles

per hour, more than twice as much gasoline is required to go the same distance as would be necessary at 20 miles per hour.

In addition, high speeds tend to wear out a car quicker. The same is true with respect to tires. Modern cars last longer and give better service when driven at speeds not exceeding 40 miles per hour.

SPEED AND FLOW.

Considerable study has been devoted to determining the maximum volume of a single line of traffic moving at different speeds past a particular point. Off-hand, one might be tempted to guess that the higher



° FIG. 3. — MAXIMUM VOLUME OF ONE LANE OF VEHICULAR TRAFFIC AT VARIOUS SPEEDS

the speed the greater the volume, but this is not so, for, as the speed increases, vehicles travel farther apart. Fig. 3 is based on average results of studies made on this subject by six different men. Some of them obtained their figures by theoretical assumptions and others by actual road tests. Observe that from the standpoint of securing the passage of the greatest number of cars in the shortest possible time, a speed of from 15 to 20 miles per hour should be maintained. However, in practice a rate of 2,000 cars per hour is seldom, if ever, quite reached.

The typical Sunday parade on a highway is due to the added number of cars automatically reducing the speed of all. These extra vehicles cause the distance between the cars to become shorter. Motorists tend to travel at known rates of speed when the distance between their cars

becomes a certain amount. Such distances and speeds may be figured from this curve.

SPEED AND CONTROLLABILITY

Tests have established that it takes the ordinary automobile operator about half a second to perceive any emergency, and to take appropriate action. This means that during such time the vehicle is not under complete control. The distance traveled during half a second varies as a straight line function, and is equal to $\frac{11}{15} M$, where M = the speed in miles per hour.

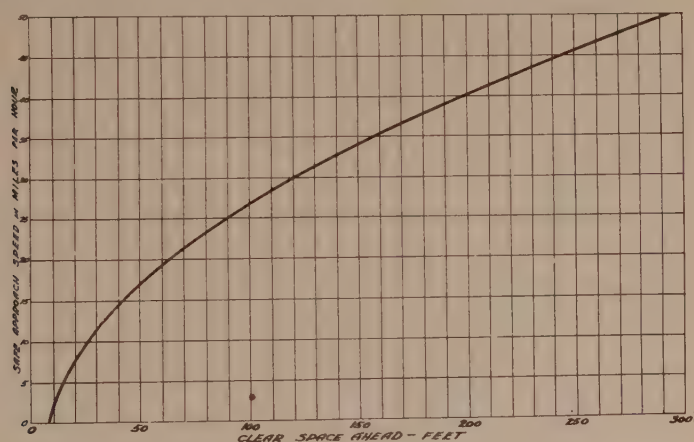


FIG. 4. — SAFE-APPROACH SPEED FOR THE CLEAR SPACE AHEAD

There are many variables which should be considered relative to breaking distances. If, however, a car is assumed to have slightly better than average brakes, and a level road surface of bitumen is smooth and dry, then $\frac{M^2}{10}$ represents the braking distance under these circumstances quite accurately. Note, therefore, that the braking distance increases as the square of the speed.

Safe Speed for the Clear Space Ahead. — If the formula for the distance traveled in half a second, prior to applying the brakes, and the formula for the distance traveled after the brakes have been applied are added together, and to these is added 8 feet (a common distance for a front bumper from a driver's eye), then we have established a formula for the distance needed for a driver to stop his car at any

speed. Let D equal such a distance in feet, then $D = \frac{M^2}{10} + \frac{11M}{15} + 8$.

The curve is shown in Fig. 4.

This D is the amount of notice in terms of clear space ahead which an operator would require in order to bring the front of his car to rest at the spot where a collision might occur. The sudden appearance of a child in the roadway or that of another car from a side street are everyday occasions for such emergency stops. By solving for M , the safe approach speed may be determined for any given distance.

Safe Speeds for Turns. — At high speeds a turn made a little too sharply for passing another car or in dodging a person or chuck hole

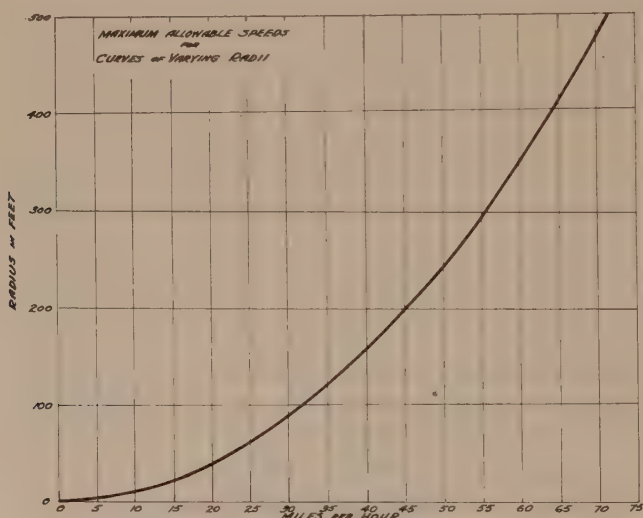


FIG. 5. — MAXIMUM ALLOWABLE SPEEDS FOR CURVES OF VARYING RADIUS

may easily result in a serious skid or complete loss of control. The critical point comes when the force (Ma) due to inward acceleration of the rotating car, just equals the force (Wc) due to the friction-producing qualities of the road surface.

Let M = the mass of the car

W = the weight of the car

a = the inward acceleration

c = coefficient of friction

then $Ma = Wc$. Substituting $\frac{W}{g}$ for M , we get $a = cg$. But $a = \frac{V^2}{r}$ in any rotating body. Therefore $V^2 = cgr$.

Let $c = .7$ (the usual coefficient of friction found on highways), then $V^2 = 22.54 r$ (V is in feet per second; r is in feet).

This relation is shown in Fig. 5.

Noting that the controllability decreases in both the ability of a driver to stop and to take curves as a function of the speed squared, it is evident that the speed maniac is almost powerless to exert any reasonable control whatever over his car.

PREFERRED SPEEDS

The only rational justification for increasing speed is to save time. If such a saving is relatively small, and if in addition it is not commensurate

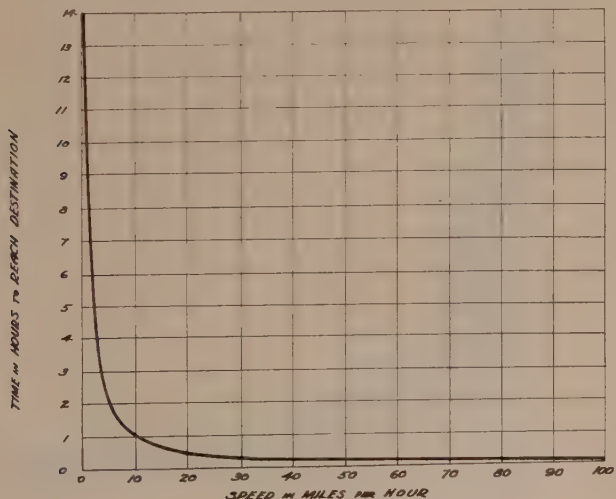


FIG. 6. — RELATION OF TIME AND SPEED FOR A DISTANCE OF 10 MILES

surate with the extra fatigue, and considering the additional vehicle operating cost and the increased hazard involved, then such higher speeds are *not* justified.

When it comes to saving time, why is it that the dashing, spurting speed demon seems never to reach his destination much sooner than his more conservative friend who adopts a moderate, even pace? Why is it that when two cars start on a cross city run in which one goes as fast as possible, disregarding all traffic rules, and the other drives carefully, obeying each and every traffic regulation, the time of arrival between them differs so little? Is there an explanation? Yes, it is

according to law, which prescribes the relation of time and speed to distance. This law is different, however, from any which we mortals have yet devised; it is impossible to violate it or even to escape it. It says that at very low speeds the time which one may save by going faster is great, while at very much higher speeds the time which one may save by an equal increase in speed is very small.

Mathematically this law is expressed by the familiar velocity equation $y = \frac{k}{x}$ in which y is the time required to travel the distance k at the rate of speed x .

The curve for this equation is a rectangular hyperbola, and is illustrated in Fig. 6, for which the distance to be traversed is 10 miles.

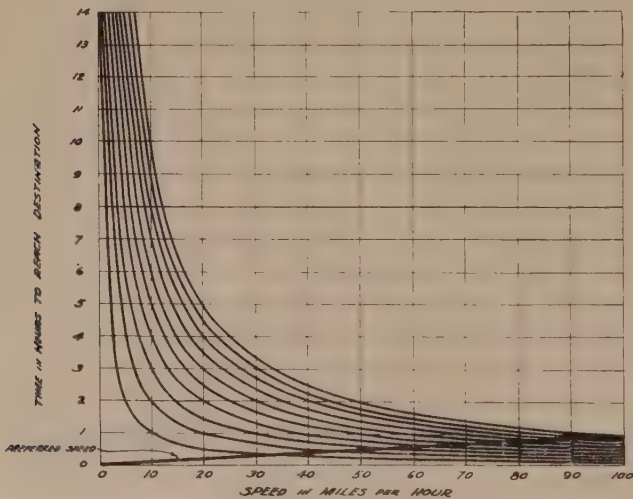


FIG. 7. — RELATION OF TIME AND SPEED FOR DISTANCES OF FROM 10 TO 100 MILES

Observe the great saving in time ($8\frac{1}{3}$ hours) resulting from increasing the speed from 1 mile per hour to 6 miles per hour — (a change of 5 miles per hour) as compared with a saving of only $1\frac{2}{3}$ minutes for an equal increase of speed from 40 to 45 miles per hour.

The same sort of effect may be discovered for any other distance which may be selected. A family of curves for distances varying from 10 to 100 miles have been plotted in Fig. 7.

It is apparent that some point along the curves could be selected above which it is, one might say, futile to increase the speed. Such a

point has been selected. It is where the ratio of $\frac{y}{x} = \frac{1}{100}$. The line on the chart marked "Preferred Speeds" intersects each curve at such a point.

The selection of this point is entirely arbitrary, and this particular choice was made largely because the resulting speeds somewhat fit the general paces adopted by operators, and because the point was well along on the flat part of the curve, thus utilizing substantially all of time-saving effect of speed increases. A ratio of $\frac{y}{x} = \frac{1}{10}$ would also yield good results, but the preferred speeds would be one-half of those found by using the former selection.

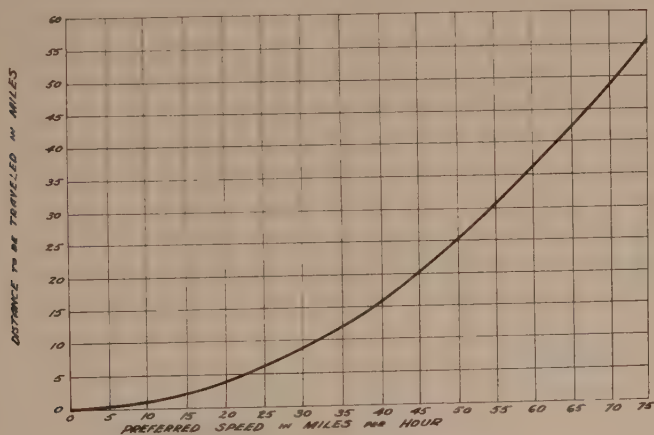


FIG. 8. — PREFERRED SPEEDS

To obtain an equation of preferred speed in terms of distance and velocity, substitute $y = \frac{x}{100}$ in the equation $y = \frac{k}{x}$. We get $x^2 = 100k$ or $x = 10\sqrt{k}$.

The curve representing this equation is shown in Fig. 8. From this curve the preferred speed may be found for any particular distance to be traveled.

Conclusions with Regard to Speed Legislation. — A "reasonable and proper" clause, although harmless, is actually completely covered by a "clear space ahead" requirement. The "clear space ahead" principle is a far more concrete idea to the motorist than is the "reasonable and proper" provision. Moreover, it tends to cast suspicion on those who have accidents and in this way tends to be self-enforcing.

Definite speed limits should be set for the different types of general conditions which are frequently met and easily recognized by every motorist. Inasmuch as such limits cannot be made flexible enough to meet the many cases where an exception is justifiable, it is believed that the exceeding of such speeds should be only *prima facie* evidence of a violation.

Application of the Principle of Preferred Speeds. — Suppose one commuted daily between two points 10 miles apart, at what pace should he travel? The answer is from 30 to 35 miles per hour ($33\frac{1}{3}$ miles per hour to be exact). No great amount of time would be saved by driving any faster.

Suppose that about halfway on the trip four minutes were lost waiting for a train to pass on a grade crossing. Should the driver attempt to make up for the time lost? No — that is, not unless he wishes to finish the trip at a 60 miles per hour pace.

Time which is lost on a trip where an operator is maintaining the preferred speed is gone, and no attempt should be made to regain it by increasing the rate of travel. The proper thing to do is to simply resume speed and forget about the loss.

Studies* made of the state highway systems of various states indicate that the mileage per trip appears to be as follows:

In Ohio, more than 60 per cent of the passenger cars travel 30 miles or less.

In New Hampshire, 63.2 per cent of the passenger cars travel 79 miles or less.

In Vermont, 62.6 per cent of the passenger cars travel 49 miles or less.

In Connecticut, 55.7 per cent of the passenger cars travel 19 miles or less.

In Pennsylvania, 55.5 per cent of the passenger cars travel 29 miles or less.

Preferred speeds covering this range of distances are from about 45 to 90 miles per hour. This does not mean that it is wise for operators to attempt to drive at such speeds; but it does mean that the roads should be of such a design that the majority may safely and comfortably utilize the general highway pace of 35 to 40 miles per hour.

Limitations of the Automobile. — Like all forms of transportation, the automobile is limited to certain maximum speeds. Taking such maximums as preferred rates of speed, it is possible to determine the maximum

* Transportation Surveys by the United States Bureau of Public Roads and the corresponding state highway departments.

distance for which an automobile may be used as an efficient device for the saving of time.

Speeds specified for highway conditions by the various states range from twenty miles per hour in Massachusetts to fifty miles per hour in Nevada. Taking these rates as preferred speeds the automobile could travel 4 miles in Massachusetts and 25 miles in Nevada efficiently. Actually, of course, very little significance can be attached to these two extremes in speed limits.

Since the general highway pace is never higher than 40 miles per hour, the greatest distance which an automobile driven at this rate can cover efficiently in this case is 16 miles.

Assuming that an automobile cannot be operated economically above 40 miles per hour, then the distance limit corresponding to such a preferred speed is 16 miles.

Fatigue, under perfect driving conditions, probably does not become material until speeds in excess of 50 miles per hour are reached. On this basis the distance limit becomes 25 miles.

If, for some reason, maximum lane flow is desired, then automobiles are not an efficient means of transportation for a greater distance than 4 miles.

There is no maximum point or general mode for controllability, so that choice of a speed must be arbitrary. Assuming, therefore, that a clear space ahead of 300 feet is always available, then the safe speed would be 50 miles per hour. Also it is interesting to note that a car moving at this speed can negotiate a curve with a 250-foot radius. In this case 25 miles is the efficient operating limit.

At the best, therefore, an automobile can be used as an efficient time-saving device only when not required to go any farther than 25 miles.

Choosing the Best Means of Transportation. — When one has a certain distance to travel, and the saving in time is important, he should select that means of transportation which most nearly approaches the preferred speed corresponding to the distance to be traveled.

For example, if one had a 40-mile trip to make he should look for a conveyance that will take him there at about 65 miles per hour, all other things being equal. He would probably have to choose between an aeroplane, which would go 90 miles per hour, and an express train which would go 50 miles per hour. Since it is as much a waste to choose a speed above the preferred as it is to choose one that is below, the proper choice in this case would be the express train.

If, however, the distance were 100 miles the aeroplane would prove by far the most efficient.

For a distance of 200 miles an aeroplane should be taken that will travel 140 miles per hour. If the distance is 500 miles, the speed to be attained is about 220 miles per hour. Obviously, for distances longer than this the aeroplane is the best possible method of transportation until such time as the rocket ship is perfected.

The whole subject of speed needs more than superficial thought — it needs scientific investigation and analysis, and it needs it now. Hence, if the material presented in this paper can stimulate thought and action among those who are scientifically minded, it will have accomplished something very much worth while.

OF GENERAL INTEREST

MEMOIR

William E. McClintock*

DIED MARCH 2, 1930

WILLIAM EDWARD MCCLINTOCK was born in Hallowell, Me., on July 29, 1848, the son of Capt. John McClintock, a well-known navigator, familiar with every sea, who crossed the Pacific with an ordinary watch for a chronometer and a school atlas for a chart, and Mary Bailey (Shaw) McClintock. On his paternal side he was of Scotch-Irish ancestry, descended from William McClintock, a defender in the Siege of Londonderry in 1689. His earliest American ancestor was William McClintock, who came to the United States, a babe in arms and whose parents settled in Medford, Mass., in 1735. On his mother's side he was descended from the Rev. John Bailey, a prominent Puritan clergyman.

Mr. McClintock's early education was acquired in the public schools, supplemented by a four-year course at Hallowell Academy, and one year at Kent's Hill Seminary, at Readfield, Me. His early manifested taste for engineering was inherited from his paternal family, his grandfather, William McClintock, having been an expert land surveyor, some fine examples of whose work are now on file in the State of Maine.

On the completion of his preparatory education Mr. McClintock entered a period of training for his profession, including both office and field work, and he also received instruction from a private tutor. His first work as an engineer was in connection with the United States Coast and Geodetic Survey, with which he was engaged from 1867 to 1876 on work in Maine, Massachusetts, New York, North Carolina, South Carolina, Georgia, Florida, Louisiana and Mississippi. From 1876 to 1879 he was employed on a survey of the city of Portland, Me., and from 1877 to 1879 on a survey of Boston Harbor, and also on a relocation survey for the Boston & Maine Railroad Company, including all its branches in Massachusetts. In 1880 he was elected city engineer of Chelsea, Mass., which position he retained until 1890, when he went into business with Mr. J. Leslie Woodfall under the name of McClintock & Woodfall.

Mr. McClintock's special engineering works have included surveys for the South Pass Jetties, at the mouth of the Mississippi River; surveys for the improvement of the harbors of New York, N. Y., Boston, Mass., and Portland, Me.; surveys for the improvement of the Saco, Savannah, Pamlico, St. Mary, St. John, and Nassau rivers; and the installation of sewerage systems for the cities and towns of Chelsea, Revere, Gardner, Westfield, East Hampton, Andover, Lenox, Natick and Lexington, Mass.; Bennington, Vt.; Bath and

* Memoir prepared from data in files of American Society of Civil Engineers.

Calais, Me.; Exeter, N. H.; and St. Stephen and Milltown, N. B., Canada. He also served as consulting engineer on sewer and waterworks construction in Holyoke, Spencer, North Brookfield, North Attleborough, and several other towns in Massachusetts as well as in other states.

Mr. McClintock was actively identified with the good roads movement in Massachusetts, and, in its advocacy, he wrote various papers, and delivered addresses in nearly every city and town in the Commonwealth. In 1892 the old League of American Wheelmen, which had been agitating the question of better roads for several years, was publishing a magazine in an effort to stimulate public interest. At that time Mr. McClintock was building roads in various towns in Massachusetts, Maine and New Hampshire. Through the efforts of the League, Governor W. E. Russell appointed a commission to investigate and report on the improvement of highways in Massachusetts, and Mr. McClintock was appointed as the engineer member, together with George A. Perkins, a lawyer, and Nathaniel Shaler, widely known as professor of geology at Harvard University. The result of the studies of this commission showed that outside the thickly settled communities there were practically no good roads in the State.

In 1893 the Legislature passed an act providing for the establishment of the Massachusetts Highway Commission, and these same three men were appointed to form the new commission. Mr. McClintock was subsequently re-appointed by Governors Greenhalge, Walcott, Crane, Guild and Bates. In 1898 he was made chairman of the commission, which position he retained until 1908, when he relinquished this work to give his services to his own home town which had been recently devastated by fire. He may be identified as pioneer in

the good roads movement, and had much to do with organizing the engineering staff that was to carry out the Massachusetts system of road-building, — a system which has been widely studied and copied throughout the country. He was nationally known as the "Father of Good Roads."

It was during his administration as chairman of the Massachusetts Highway Commission that the increasing motor vehicle traffic showed the impracticability of the water-bound macadam highway which until that time had been considered the finest road in existence. Under Mr. McClintock's leadership the bituminous macadam highway was devised, and it has since been the standard for the superior motor highway, except in sections of the heaviest travel, where concrete has been adopted.

In 1908 came the Chelsea fire, during which more than 17,000 people were rendered homeless, and churches, public buildings and schools were destroyed. Mr. McClintock was the man to whom everyone looked to take charge of the relief operations, and so effectively was this done that when it was decided that Chelsea was to have an emergency commission form of government for five years, Mr. McClintock was selected by Governor Eben Draper as chairman of the Board of Control. In this capacity he again had an opportunity to show his executive and constructive ability in the rebuilding of the city, and to this end he gave unremittingly of his time and service. Despite some opposition and many difficulties, this Board brought Chelsea out of its stricken condition. It rebuilt all the public buildings, laid out new streets, and left the city with better structures than it had previous to the fire. It was while he was engaged wholeheartedly in this work that he was recognized by Governor Charles E. Hughes of New York State as the leading authority in the United

States on the construction of modern highways, and he was invited to accept the chairmanship of the New York Highway Commission. He refused this offer because he was devoted to his community and to the work on hand.

In 1913, when the city returned to the mayor and board of aldermen form of government, he was appointed superintendent of Chelsea Ferry, which position he held until the ferry was discontinued. He then became connected with the State Department of Education, in its field of University Extension. He died at his home in Chelsea on March 2, 1930, in his eighty-second year.

Mr. McClintock served on the board of aldermen and school committee, and was a vice-president of the Chelsea Savings Bank. He was one of the organizers and first president of the Massachusetts Highway Association, a member of the American Society of Civil

Engineers, and in addition an instructor in highway engineering at Lawrence Scientific School, at Harvard University. He was a member of the Robert Lash Lodge of Masons and the Royal Arch Chapter of the Shekinah and of the Review Club. He was prominently connected with the Church of the Redeemer (Universalist) of Chelsea.

He was married in Portland, Me., in 1873, to Mary Estella Currier. They had five children, all of whom are living: William J. of Melrose, Mass.; Dr. Francis B. and Samuel of Chelsea; Paul of Hillside, N. J.; and Dorothy of Chelsea.

Mr. McClintock was elected a member of the Boston Society of Civil Engineers on December 15, 1880, and an Honorary member January 25, 1922. He was President of the Society in 1894.

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETINGS

Boston Society of Civil Engineers

FEBRUARY 18, 1931. — A regular meeting of the Boston Society of Civil Engineers was held today in Lorimer Hall, Tremont Temple, and was called to order by the President, Lewis E. Moore, at 7 p.m. This meeting was the usual joint meeting with the following student engineering societies:

Northeastern University Section of Boston Society of Civil Engineers.
Student Chapters, American Society of Civil Engineers, of —
Harvard Engineering School.
Massachusetts Institute of Technology.
Tufts College.

About 275 were present at the meeting and 260 attended the buffet supper and

smoker which preceded it. During the supper music was provided by the Northeastern University orchestra.

The President announced the death of Henry A. Symonds on February 17, 1931, who had been a member since December 16, 1896.

The Secretary announced that the following had been elected to membership by the Board of Government on February 18, 1931:

Grade of Member: John R. Dyer.

Grade of Junior: Richard H. Hamill.

The President announced that this was the usual annual joint meeting of this Society with the student civil engineering societies of Technology, Tufts, Harvard and Northeastern University.

The President then introduced Mr. Frederic H. Fay, Past President of the Society and Chairman of the City Planning Board of Boston, who gave an outline

of the report of that Board on "A Thoroughfare Plan for Boston." Following his talk Mr. Robert Whitten, City Planning Consultant for that Board, gave a very interesting account of the studies which have been carried on during the last three years, including traffic analyses and forecast, and giving in detail many of the projects recommended for the modernizing of the major traffic streets of Boston, and particularly the project of a new main thoroughfare route through the city.

Following these speakers there was some discussion and a number of questions relating to the proposed ways.

Meeting adjourned at 9.45 P.M.

EVERETT N. HUTCHINS, *Secretary*.

MARCH 18, 1931. — The Eighty-third Annual Meeting of the Boston Society of Civil Engineers was held today at the Boston City Club, and was called to order by the President, Lewis E. Moore, at 4.30 P.M.

The reading of the minutes of the previous meeting (February 18, 1931) was omitted, as these will be printed in the April JOURNAL.

The Secretary reported the names of those elected to membership by the Board of Government on March 18, 1931, as follows:

Grade of Member: John C. Taggart, Jr., Norman Mackenzie Winch.*

Grade of Junior: Raymond Gustaf Rolin.

The annual reports of the Board of Government, Treasurer, Secretary, Committees on Social Activities and Library, were presented.

It was *Voted* that these reports be accepted and placed on file.

The report of the Committee on Subsoils of Boston was read by the Chairman, H. E. Sawtell. *Voted* that this report be accepted and referred to the incoming Board of Government.

The President expressed the appreciation of the Society for the painstaking work of this committee in assembling and arranging the data on this subject.

It was *voted* that the incoming Board of

Government be authorized to appoint such committees as it deemed advisable.

Mr. Albert Haertlein presented the report of the Tellers of Election, and in accordance therewith the President announced that the following officers had been elected for the ensuing year:

President — Harry E. Sawtell.

Vice-President — Arthur W. Dean (for two years).

Secretary — Everett N. Hutchins.

Treasurer — Karl R. Kennison.

Directors (for two years) — Gordon M. Fair, Arthur D. Weston.

Members of Nominating Committee (for two years) — Henry B. Alvord, Charles W. Banks, George E. Harkness.

The President introduced Harry E. Sawtell, the newly elected President, who responded briefly.

The other newly elected officers, by way of introduction, were asked to rise as their names were read.

The retiring president, Lewis E. Moore, then delivered his annual address on "A Suggestion for Engineering Education."

The meeting adjourned to assemble again at 7.15 P.M., the dinner being held during the interim.

The President, Lewis E. Moore, then called the meeting to order in the auditorium for the presentation of prizes. He announced that the Board had voted to give a prize, consisting of books, which he presented to each of two co-authors, for their paper on "The Angular Rotation Method for the Analysis of Multiple Span Frames," published in the December, 1930, JOURNAL, and presented at the meeting of the Designers Section on February 12, 1931; to Raymond A. Freeman a copy of Timoshenko's "Strength of Materials," and to Alexander S. Gelman a copy of "Frontinus and the Water Supply of Rome," by Clemens Herschel.

The President announced that the Board had voted to give a copy of the late Clemens Herschel's book, entitled "Frontinus and the Water Supply of Rome," to Edwin A. Dow for his paper on the "Hydraulic and Mechanical Features of the Bellows Falls Hydro-Electric

* Transferred from grade of Juniors.

Plant," presented at a meeting of the Society on February 19, 1930, and published in the March, 1930, JOURNAL.

The President then presented the Desmond FitzGerald medal to H. B. Kinnison for his paper on "Stream-Flow Data — Its Collection and Use," presented at a meeting of the Society on April 16, 1930, and published in the May, 1930, JOURNAL.

On motion made by H. E. Sawtell it was *Voted* that the Society present to Mr. Whitney, the retiring Treasurer, an inscribed copy of the following:

"An Expression of Appreciation to Frank Ormond Whitney from the Boston Society of Civil Engineers.

"For sixteen years, beginning in March, 1915, Frank Ormond Whitney has served the Boston Society of Civil Engineers as its Treasurer. This has been a labor of love on his part, as the office carries no emoluments, and he has requested that he be relieved from his duties.

"The members of the Society, assembled in annual meeting, wish to express to Mr. Whitney their appreciation of his faithful and painstaking service in this office for the past sixteen years, and to express the hope that his interest in the Society will continue for many years to come.

"For the Boston Society of Civil Engineers.

LEWIS E. MOORE,
President."

Whereupon the President presented a framed copy of this appreciation to Mr. Whitney, which was duly acknowledged amidst the applause of those present.

The meeting then adjourned to enjoy the program of entertainment. Ladies, as guests of the members, were admitted to the gallery to enjoy these features of the program.

One hundred and sixty-seven members of the Society and guests attended the dinner.

A lecture illustrated by stereopticon and moving pictures on "The Erection of the Kill Van Kull Arch Bridge," at New York was presented by Mr. H. W. Troelsch, Engineer, American Bridge Company.

Another lecture on "How the News is Gathered" was given by Lieut. Robert S.

Fogg of Concord, New Hampshire, who described vividly his adventures as aviator, with his camera man, in getting first pictures for news reels of events at the time of the landing of the German plane "Bremen" in Labrador on its trans-Atlantic flight.

EVERETT N. HUTCHINS, *Secretary.*

Sanitary Section

MARCH 4, 1931. — Annual Meeting. At 6 P.M. 28 members and guests dined at Patten's restaurant.

The meeting was called to order at 7.15 P.M. in the Societies' Library by the Chairman. The minutes of the previous meeting were accepted without being read, subject to publication in the JOURNAL.

The report of the Executive Committee was read and accepted.

The report of the Nominating Committee was read and accepted.

It was *Voted* that nominations be closed and that the clerk cast one ballot for the nominees presented by the Nominating Committee. The clerk cast one ballot as directed.

The following officers were elected for the ensuing year:

Chairman — Francis H. Kingsbury.

Vice-Chairman — Stuart E. Coburn.

Clerk — George G. Bogren.

Executive Committee — Thomas R. Camp, Harrison P. Eddy, Jr., C. Fred Joy, Jr.

The Chairman-Elect was introduced and spoke briefly.

The Chairman then introduced the speaker of the evening, George G. Nasmith, M.A., Ph.D., D.Sc., D.P.H., C.M.G., of the firm of Gore, Nasmith & Storrie, Consulting Engineers, of Toronto, Ont. The Chairman described at length the speaker's remarkable career in his profession and as an officer in the Canadian Expeditionary Force.

Dr. Nasmith spoke on the "Trial Water Filtration Plant at Ottawa." His talk was illustrated by lantern slides. He summarized the results of nine months' experiments in the laboratory and in the

miniature plant, upon which the design of the city's new plant is based. Among the interesting conclusions reached through experimentation at Ottawa, the following may be cited:

1. Under optimum filtration conditions, removal of alum "floc" takes place throughout the entire depth of sand, and not at the surface alone.

2. The length of filter "run" is directly proportional to the depth of sand.

3. Optimum coagulation occurs at pH 5.1 to 5.4.

4. It is possible to remove 85 per cent of the color in coagulation basins of 2 hours' detention period.

5. Mixing tank design has a marked effect upon filtration efficiency.

6. Sedimentation is affected by differences in temperature, between basin surface and bottom, of 0.5 degree and less.

He warned against the fallacy of assuming that apparently similar waters can be similarly treated, and advocated the operation of experimental plants to guide the design of large plants.

After his talk Dr. Nasmith answered innumerable questions by many members. A rising vote of thanks was extended the speaker.

Attendance, 48.

Meeting adjourned at 9 P.M.

GEORGE G. BOGREN, *Clerk*.

Designers Section

MARCH 11, 1931. — The annual meeting of the designers section was called to order at 6.10 P.M. by Vice-Chairman L. M. Hersum in Chipman Hall.

The minutes of the February meeting were read and accepted.

The report of the Nominating Committee was then read by Waldo F. Pike, Chairman. There being no additional nominations made, the motion was carried that the clerk be instructed to cast a ballot for the nominees as submitted. Thus, the following officers were elected for the year 1931-32:

Chairman — Erwin Harsch.

Vice-Chairman — Lawrence G. Ropes.

Clerk — Raymond A. Freeman.

Executive Committee — Frederic N. Weaver, Charles E. Tirrell, Leon B. Turner.

Mr. J. Stuart Crandall spoke on the subject of "Resistance of Piles." He developed various pile formulæ showing the assumptions involved in each, and stressed the limitations of these formulæ.

Several of those present took part in the discussion which followed.

The meeting adjourned at 7.25 P.M.

There were 95 members and guests in attendance.

RAYMOND A. FREEMAN, *Clerk*.

Highway Section

FEBRUARY 25, 1931. — The annual meeting of the Highway Section was held Wednesday, February 25, in the Engineering Societies' Rooms.

The Chairman, Mr. James E. Lawrence, called the meeting to order at 7.15 P.M. The reading of the minutes of the previous meeting was omitted. The report of the Executive Committee for the past year was read and accepted. Acting upon Mr. Lawrence's suggestion the members stood and bowed their heads in memory of four members who died during the past year, namely, J. V. Corbett, W. H. Cronin, C. A. Mason and W. L. Vennard.

The report of the Nominating Committee was read by Mr. R. W. Coburn. It was voted that the report be accepted and that the Clerk cast one ballot for the nominees presented by the Nominating Committee.

The following officers were elected for the coming year:

Chairman — A. B. Edwards.

Vice-Chairman — Edwin H. Rogers.

Clerk — Arthur P. Rice.

Executive Committee — J. B. Babcock, Ernest Mathers, Francis T. McAvoy.

Mr. Edwards then took charge of the meeting, introducing the speaker of the evening, Mr. Clarence P. Taylor, Traffic Engineer of the Massachusetts Depart-

ment of Public Works. Mr. Taylor presented a very interesting and instructive paper on "Preferred Speeds." Mr. Taylor used lantern slides to show various mathematical curves illustrating preferred speeds, the relationship of speed, time and distance, required distance to stop, etc.

He discussed various methods of transportation, including the automobile, train and airplane, explaining the time economy of each mode of transportation for various speeds and distances. A discussion followed in which various members and guests took part.

There were 28 members and guests present at the meeting.

The meeting adjourned at 8.35 P.M. after according Mr. Taylor a rising vote of thanks.

ERNEST MATHERS, *Clerk.*

APPLICATIONS FOR MEMBERSHIP

(April 20, 1931)

THE By-laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

For Admission

FREIHEIT, JOHN LEWIS, Shelton, Conn. (Age 21, b. Shelton, Conn.) A student at Northeastern University, and during co-operative periods has worked as a surveyor with Cobb, Beesley & Miles, Springfield, Mass., with Herbert Richardson, South Harwich, Mass., and with Henry R. Buck, Hartford, Conn. Refers to *H. B. Alword, C. O. Baird, C. S. Ell, W. E. Nightingale.*

GALLAGHER, ERNEST FRANCIS, Medford, Mass. (Age 30, b. Somerville, Mass.) Graduate of Huntington School in 1918; of Massachusetts Institute of Technology in 1922, with B.S. in architectural engineering. Experience: employed as appraisal and structural engineer with Lockwood Greene Company until November, 1924; sales engineer with Scammell Lath Company until July, 1926; from then to February, 1927, with Robert Tappan, Architect, Forest Hills, N. Y., as office manager; from February, 1927, to February, 1930, sales engineer for Standard Electric Time Company of Springfield, Mass.; at present is employed as district engineer with Common Brick Manufacturers Association of America. Refers to *J. F. Brittain, W. H. Lawrence, N. P. Randlett, V. S. Tarr.*

KENNEDY, JOHN FRANCIS, Somerville, Mass. (Age 32, b. Boston, Mass.) Educated in Boston public schools and Mechanics Arts High School, and Suffolk Law School, two years. Engaged in contracting business since 1922 in Boston and Cambridge. He is a general contractor, doing business as John F. Kennedy & Co. Refers to *G. S. Coleman, C. S. Drake, F. A. Garvin, J. A. Rourke, E. J. Ryan.*

KOMICH, JOHN B. JOSEPH, South Boston, Mass. (Age 20, b. South Boston, Mass.) He is a student at Northeastern University, and during summers and co-operative periods has worked for Aspinwall & Lincoln. Refers to *H. B. Alword, C. O. Baird, L. A. Chase, W. H. Connor, J. A. C. Komich.*

MACDONALD, LAUGHLIN CEDRIC FRANCIS, Jamaica Plain, Mass. (Age 22, b. Roxbury, Mass.) Two years' experience as assistant field engineer with the Whitney

Engineering Company, formerly Whidden-Beekman Construction Company, and two years at Lowell Institute in building construction course. Refers to *H. G. Gray, D. C. Milne, E. J. Theriault, C. A. Wolfrum.*

SHERMAN, LESLIE, West Medford, Mass. (Age 23, b. Everett, Mass.) Received degree of B.S. in civil engineering from Tufts College in 1929, and M.S. in sanitary engineering from Harvard University in 1930. While still attending college worked summers at engineering: summer of 1927 as transitman in engineering department, city of Medford; summer of 1928, as draftsman, inspection department, Associated Factory Mutual Fire Insurance Companies; summer of 1929 as assistant to R. L. Reed, resident engineer of H. A. Symonds; summer of 1930, as assistant sanitary engineer, Connecticut State Department of Health; since 1930 has been employed as assistant to Prof. G. M. Fair in the department of sanitary engineering, Harvard University. Refers to *H. P. Burden, S. L. Conner, G. M. Fair, Albert Haertlein.*

TOWERS, FREEMAN WEBSTER, East Lynn, Mass. (Age 22, b. Lynn, Mass.) Is a student at Northeastern University. During co-operative periods has been employed in the Massachusetts Department of Public Works, Division of Highways, as junior engineering aid. Refers to *H. B. Alvord, C. O. Baird, J. W. Ingalls, W. E. Nightingale.*

Transfer from Grade of Junior

FREEMAN, RAYMOND A., Belmont, Mass. (Age 30, b. Brooklyn, N. Y.) Graduate of Massachusetts Institute of Technology, 1926. From June, 1926, to February, 1927, transitman with D. P. Robinson; March, 1927, to date, with Jackson & Moreland, on field construction work, eight months; valuation, eight months; two years on structural, foundation and catenary design; six months on structural design for power plant. Refers to *W. W. Bigelow, E. H. Cameron, W. D. Henderson, W. H. Smart, F. N. Weaver.*

ADDITIONS

Members

JOHN R. DYER, Truro, Cape Cod, Mass.
JOHN C. TAGGART, Jr., 60 Charlesgate East, Boston, Mass.

Juniors

ALFRED C. ANDERSON, East Foxborough, Mass.
MILLARD H. AUBEY, 260 Union Street, Framingham, Mass.
JOHN R. CARLSON, 279 Main Street, Milford, Mass.
JOSEPH H. COFFEY, 4 Verndale Street, Bradford, Mass.
EUGENE B. CONDON, 61 Birch Street, Roslindale, Mass.
ALGOT O. FORSBERG, 43 Presentation Road, Brighton, Mass.
KENNETH H. GILSON, 30 Marble Street, Stoneham, Mass.
FRANCIS H. LEDGARD, 31 Parker Street, Maynard, Mass.
A. ALBERT MINICHELLO, 44 Ashley Street, East Boston, Mass.
GEORGE K. NORTON, 9 Upham Avenue, Boston, Mass.
EDWARD J. PARSONS, Jr., Gloucester, Mass.
ROBERT W. PERRY, Margin Street, Cohasset, Mass.
CHARLES V. SCHER, 47 Bridge Street, Beverly, Mass.
MERTON C. SMITH, 247 Kent Street, Brookline, Mass.
THERON B. THOMPSON, 280 Green Street, Stoneham, Mass.
ALBERT P. WHITAKER, 100 Gainsboro Street, Suite 2, Boston, Mass.

DEATHS

JAMES E. CASHMAN . . Feb. 24, 1931
HENRY A. SYMONDS . . Feb. 17, 1931
LESTER W. TUCKER . . Mar. 24, 1931

ANNUAL REPORTS

Report of the Board of Government for the Year 1930-31

BOSTON, March 18, 1931.

To the Boston Society of Civil Engineers:

Pursuant to the requirements of the By-Laws, the Board of Government presents its report for the year ending March 18, 1931.

Membership

Fifty-two members in all grades have been added during the year, of whom 15 were former members reinstated. Seven juniors have been transferred to the grade of member.

During the year 17 members have died, 24 have resigned, 28 have forfeited membership for non-payment of dues, making the total deductions 69.

The present membership of the Society consists of 3 honorary members, 841 members, 184 juniors, 19 associates, and 1 member of the Sanitary Section only, making a total membership of 1,048, a net loss for the year of 17.

Deaths

Lawrence E. Kilpatrick, March 19, 1930.
William Warren Cummings, April 5, 1930.
William L. Vennard, April 29, 1930.
John V. Corbett, May 14, 1930.
James Mauran Betton, May 29, 1930.
James Rice, May 29, 1930.
Elliott Howes Gage, July 13, 1930.
Allen Hazen, July 26, 1930.
William H. Cronin, Aug. 14, 1930.
Ira N. Hollis, Aug. 14, 1930.
Daniel Webster Pratt, Sept. 16, 1930.
Erastus Roland Simpson, Sept. 24, 1930.
Edward W. Henck, Oct. 26, 1930.
Charles A. Mason, Dec. 31, 1930.
John E. Titus, Jan. 18, 1931.
Henry A. Symonds, Feb. 17, 1931.
James E. Cashman, Feb. 24, 1931.

Remission of Dues

Under authority of By-Law 8, the Board of Government has remitted the dues of five members.

Exemption from Dues

Sixty-seven members are now exempt from dues in accordance with By-Law 8, which provided that "a member of any grade who has paid dues for forty years, or who has reached the age of seventy years and has paid dues for thirty years, shall be exempt from further dues."

Meetings of the Society

Nine regular meetings have been held during the year, and a joint outing with the New England Water Works Association on June 25, 1930, at the Hotel Pilgrim, Plymouth. The January, 1931, meeting was held jointly with the Boston Section of the American Welding Society.

The average attendance at the meetings of the Society was 130, the largest being 260 and the smallest 30. Buffet or cafeteria suppers have been a feature of all the meetings. At these meetings papers and addresses have been given, as follows:

March 19, 1930. — Annual Meeting. Address of retiring President, Frank E. Winsor, "Some Changes since Boston was settled Three Hundred Years Ago;" followed by dinner, smoker and entertainment.

April 16, 1930. — "Stream-Flow Data — Its Collection and Use," by H. B. Kinison, District Engineer, Water Resources Branch, United States Geological Survey.

May 21, 1930. — "Engineering and the Industries of Japan," by Charles T. Main, President of Chas. T. Main, Inc.

September 24, 1930. — "Design of Wind Bracing," by Edward Smulski of Chicago.

October 15, 1930. — "The Industrial Situation in New England," by Dudley Harmon, Executive Vice-President of the New England Council.

November 19, 1930. — Discussion of the "Report of the Committee on Floods." A. T. Safford, Chairman of the Committee; G. H. Matthes, Consulting Engineer, Norfolk, Va.; C. H. McDougal, Massachusetts Institute of Technology; J. W. Gross, Consulting Engineer, Sacramento, California, and others.

December 17, 1930. — "Golf Course Design and Construction," by Wayne B. Stiles; and "Landscape Features of Golf Courses and Surrounding Communities," by Arthur A. Shurcliff.

January 28, 1931. — "The Planning, Specifying, Supervising and Welding of the new Fourteen-Story Edison Building," by J. T. Whitney, President of The Whitney Engineering Company, Boston; J. L. Faden, Industrial Heating Engineer, Edison Electric Illuminating Company; and A. G. Leake, President, Leake & Nelson Company, Bridgeport, Connecticut.

February 18, 1931. — Joint meeting with the Student Engineering Societies of Massachusetts Institute of Technology, Harvard, Tufts and Northeastern University. "A Thoroughfare Plan for Boston," by Frederic H. Fay, Chairman, City Planning Board of Boston, and Robert Whitten, City Planning Consultant.

Sanitary Section Meetings

The Sanitary Section has held four meetings and one excursion during the year, with an average attendance of 34. The following papers have been presented:

March 5, 1930. — Annual Meeting. "Industrial Sanitation," by Theodore F. Hatch of Harvard University.

May 7, 1930. — Symposium on "Actually, Now, Are Pigs Pigs?" by Edward Wright, Francis H. Kingsbury, George C. Houser, Frank L. Flood, Prof. Gordon F. Fair, members of the Section, and Mr. Potter of Lexington.

September 26, 1930. — Excursion to Neponset Valley Sewer, conducted by Ralph W. Loud and Seth Peterson, Metropolitan District Commission.

December 3, 1930. — "Collection and Disposal of Municipal Refuse at Rochester, N. Y.," by Harold W. Baker, Commissioner of Public Works, Rochester, N. Y.

February 4, 1931. — "The Trials and Tribulations of a Sanitary Engineering Witness," by E. Sherman Chase of Metcalf & Eddy.

Designers Section Meetings

The Designers Section has held eight regular meetings during the year. The average attendance has been 34. The following papers have been presented:

March 12, 1930. — "The Circle of Stress," by Prof. L. S. Johnson of Harvard University.

April 9, 1930. — "The Separate Effects of Shears and Moments on Rigid Frame Bents," by Prof. T. H. Frost of Massachusetts Institute of Technology.

May 14, 1930. — "The Analysis of Continuous Beams and Rigid Frames by Cross's Method of Moment Distribution," by Prof. Hale Sutherland of Massachusetts Institute of Technology.

October 8, 1930. — "High Buildings in Boston," by Maurice A. Reidy, Structural Engineer, and D. W. Clapp of Blackall, Clapp & Whittemore, Architects, of Boston.

November 12, 1930. — "Fire Protection of Structural Members," by C. K. Stiff, Engineer, Associated Factory Mutual Fire Insurance Companies.

December 10, 1930. — "Deformation of Concrete under Setting and Temperature Changes," by William M. Bassett, Engineer of Structures, New England Power Construction Company.

January 14, 1931. — "Columns Subjected to Eccentric and Transverse Loading," by Kimball A. Garland, Structural Engineer.

February 12, 1931. — "The Angular Rotation Method for the Analysis of Multiple Span Frames," by Raymond A. Freeman of Jackson & Moreland, Boston, and Alexander S. Gelman, with Gibbs & Hill, New York.

Highway Section Meetings

The Highway Section has held four regular meetings during the year, with an average attendance of 22.

February 26, 1930. — Annual Meeting. "Highway Beautification," by James H. Taylor, Highway Landscape Engineer, Massachusetts Department of Public Works.

May 28, 1930. — "Bituminous Emulsions and Cold Asphalt Road Emulsions," by Col. H. L. Bowlby, General Manager, Flintkote Roads, Inc., New York.

October 4, 1930. — Inspection Trip to the Exhibit of the Massachusetts Department of Public Works, at the Exhibition of Activities of Various State Departments, Commonwealth Armory, Boston.

November 25, 1930. — "The Engineer and Beauty of the Highway," by Philip Ayers, Secretary of the Society for the Protection of Forests in New Hampshire.

Northeastern University Section Meetings

The Northeastern University Section has held, thus far, six meetings during the year.

March 28, 1930. — An excursion to inspect the construction of the extension of the Lynn Fells Parkway in Melrose and Saugus.

May 16, 1930. — Annual Meeting. "The Engineer," by Lewis E. Moore, President of the Boston Society of Civil Engineers.

October 3, 1930. — "International Road Builders," by Van Ness Bates of the Warren Brothers Company.

December 11, 1930. — "Two Methods of Reducing Geographic Positions to Rectangular Co-ordinates," by Prof. Henry B. Alvord.

January 9, 1931. — "Twin Ignition Engineering," by Albert O. Wilson, President of the A. O. Wilson Structural Company.

February 24, 1931. — "Automotive Traffic Despatching Systems," by O. M. Jacobi, Electrical Engineer, Automatic Signal Corporation.

Journal

The report of the Editor of the JOURNAL for the calendar year 1930 shows that there have been printed ten issues, containing a total of 723 pages, and an average of 1,513 copies of each issue was printed. The net cost in 1929 was \$2,854.17, or \$4.45 per page. The net cost of the JOURNAL in 1930 was \$3,812.86, or \$5.27 per page. This increased cost was due to the large number of cuts and tabulations which were a necessary part of two important papers in the JOURNAL. The report of the Editor will be printed in the April JOURNAL.

Permanent Fund

The Society again authorized the use of the income of the Permanent Fund in payment of current expenses. Details concerning the fund will be found in the Treasurer's report.

FitzGerald Fund

The present value of the fund established by a bequest from the late Desmond FitzGerald, a Past President and Honorary Member of the Society, is \$2,217.16. The income from this fund is to be used for charitable and educational purposes. The Board voted on March 10, 1931, to appropriate the sum of \$100 this year from the income of this fund to be presented to a worthy student in civil engineering at Northeastern University for the year ending June, 1931. This amount is designated as the Boston Society of Civil Engineers Scholarship, in memory of Desmond FitzGerald, and will be presented to the selected student at a special meeting of the students to be held at an early date at the University.

Freeman Fund

Clifford P. Kittredge has held the Freeman Fund Traveling Scholarship during the year beginning June, 1930. The scholarship provides for a year's study and work in the European Hydraulic Laboratories. Through the interest of Mr. John R. Freeman, an appropriation was made from this fund toward the cost of printing the Report of the Committee on Floods, which appeared in the September, 1930, JOURNAL.

Tinkham Memorial Fund

The "Samuel E. Tinkham Fund," established at the Massachusetts Institute of Technology by the Society "to assist some worthy student of high standing to continue his studies in civil engineering," had a value of \$2,705.78 on July 1, 1930. The annual income from this fund is about \$125. Mr. William Tucker Moody of North Andover, Massachusetts, a student in civil engineering in the class of 1931 at Technology, has been awarded this scholarship for the year 1930-31.

Attention is called to the fact that the tuition at the Massachusetts Institute of Technology is now \$400 per year, and is to be increased to \$500 per year beginning September, 1931, whereas the income from the Tinkham Fund is about \$125. Additional donations to this fund would make it of greater service for the purpose for which it was established.

Desmond FitzGerald Medal

In accordance with the report of the Committee, to recommend the award of the Desmond FitzGerald Medal for the best paper by a member of the Society published during the year, the Board has awarded a medal to H. B. Kinnison for his paper on "Stream Flow Data — Its Collection and Use," presented before the Society on April 16, 1930, and published in the May, 1930, JOURNAL.

Alexis H. French Fund

The Society received during the year a bequest of \$1,000 from the late Alexis H. French of Brookline, the principal of which is to be known as the Alexis H. French Fund, and the income to be devoted to the Library of the Society.

Section Prizes

The Board voted on April 12, 1924, "to present a prize for a worthy paper given in each Section by a member of that Section," this award to consist of books suitably inscribed. A strict adherence to the rules governing section awards has prevented the award of section prizes this year. The Board has, however, voted to award a prize consisting of books to each of two co-authors, Raymond A. Freeman and Alexander S. Gelman, for their paper on "The Angular Rotation Method for the Analysis of Multiple Span Frames" which had been printed in the December, 1930, JOURNAL, and presented for discussion at the meeting of the Designers Section on February 12, 1931.

The Board voted on March 10, 1931, to revise the rules governing the award of section prizes in order to provide specifically for the award of a prize to a member of the Northeastern University Section for an original paper prepared by a member of that Section and presented by the author during the year at a regular Engineering Conference meeting held at the University. Papers selected by the faculty shall be presented to the Society's Committee on awards for consideration. The prize shall consist of a book or books as for other Section awards.

Clemens Herschel Award

The late Clemens Herschel, a former Past President and Honorary Member of the Society, had assigned to the Society a number of copies of his book on "Frontinus and the Water Supply of Rome," with the request that the Board award one or more of the books each year as prizes for papers which have been particularly useful and commendable, and worthy of grateful acknowledgment.

The Board has voted to present at this time a copy of this book to Edwin A. Dow for his paper on "Hydraulic and Mechanical Features of Bellows Falls Hydro-Electric Plant of the New England Power System," presented before the Society on February 19, 1930, and published in the March, 1930, JOURNAL; and also a copy of this book to Alexander S. Gelman, co-author of a paper on "The Angular Rotation Method for the Analysis of Multiple Span Frames," published in the December, 1930, JOURNAL, and presented for discussion at a meeting of the Designers Section on February 12, 1931.

During the year the Society has received a bequest from the late Clemens Herschel amounting to \$1,000, the income of which is to be used for the same purpose.

Sections

Twenty-two meetings and one inspection trip were held by the Sections of the Society during the year. These meetings of the Sections, offering opportunity for less formal discussion, have continued to demonstrate their value to their members and to the Society. The variety of subjects presented has made an appeal to the members, as indicated by the general attendance at these meetings.

Social Activities

Four of the meetings of the year have been held at Chipman Hall, Tremont Temple, under the customary direction of the Social Activities Committee. Four other meetings during the middle of the year were held at the Boston Chamber of Commerce Building, which appealed to some members, but the majority of members appeared to prefer the former meeting place; consequently, the later meetings were held there with apparently more sociability and general satisfaction with the efforts of the Committee on Social Activities in serving the buffet suppers and smokers. As usual, the most enthusiastic meeting was the Student Night, attended by members of the student Engineering Societies of Massachusetts Institute of Technology, Harvard, Tufts and Northeastern University, at which time the orchestra of the latter school assisted in the entertainment.

Library

The report of the Committee on Library contains a complete account of the library activities during the year.

Society Activities

During the past year there has been one special committee at work, namely, the Committee on Subsoils of Boston, which has continued its excellent work of securing and making available a great deal of information about foundation conditions of Boston and vicinity. The final report of this committee will be presented at this meeting.

The Society has co-operated with the Engineering Societies of Boston in its program, and many members of the Society have served on Engineering Societies' committees.

Your Board, in conclusion, wishes to express its appreciation of the excellent work done by the officers of the Sections and by the committees of the Society.

For the Board of Government,

LEWIS E. MOORE, *President*.

Report of the Treasurer

BOSTON, March 1, 1931.

To the Boston Society of Civil Engineers:

Your Treasurer presents the following report for the year ending March 1, 1931.

Detailed data are contained in the appended tabular statement: Table 1 gives the Receipts and Expenditures for the year; Table 2, Comparative Balance Sheet; Table 3, Investment of the Several Funds.

The Current Expenses for the year amount to \$12,549.85, being \$936.31 more than for the preceding year.

There has been transferred to the Current Fund all the income of the Permanent Fund, which amount was \$2,647.16.

There has been transferred \$1,000 from the income of the Freeman Fund to the Current Fund for the defrayment of the additional cost of the September JOURNAL, the printing of the report of the Flood Committee having increased the expense of that number.

The net expense of the JOURNAL has been \$737.83 more than last year. The income from advertisements increased \$339.45, and the sale of JOURNALS and reprints has been \$24.24 less than last year.

There has been an increase in the Permanent Fund of \$420, after transferring the income for the current year of \$2,647.16 to the Current Fund.

The Freeman Fund Principal shows an increase of \$170. The balance of income amounts to \$841.33.

Two new funds have been created during the year by reason of bequests from Clemens Herschel and Alexis H. French, both Past Presidents of the Society. These donations were for \$1,000 each.

The securities owned by the Society have been carried on the books at their cost value. These securities have a market value at the present time of \$4,348.71 in excess of the cost value in the case of the Permanent Fund, and of \$4,509.50 in the case of the Freeman Fund. In the Turner Fund the increase is \$76.25. There is a loss in the FitzGerald Fund of \$124.75.

The total net gain for all assets of the Society being, therefore, \$8,809.71, the present value of the total assets becomes \$102,013.84, of which \$9,905.11 is the estimated value of the Library and furniture.

Respectfully submitted,

F. O. WHITNEY, *Treasurer.*

TABLE 1. — RECEIPTS AND EXPENDITURES

Current Fund	
<i>Receipts</i>	
Balance March 1, 1930	\$1,011 64
Members' dues	8,028 57
Advertisements (net), \$1,932.10 less \$424.65	1,507 45
Sale of JOURNALS and reprints	583 98
Library fines	13 15
Waste paper sold	2 14
Freeman Fund transferred to expense of JOURNAL	1,000 00
Income from Permanent Fund	2,647 16
	\$14,794 09
<i>Expenditures</i>	
JOURNAL:	
Printing	\$4,728 94
Reprints	326 93
Incidentals	28 50
Editor	450 00
	\$5,534 37

Rent, meetings	\$235 10	
Salary of Secretary	300 00	
Printing, stationery, postage, etc., meetings	285 84	
Printing, stationery, postage, etc., office	246 61	
Incidentals, office	205 05	
Reporting, meetings	60 50	
Stereopticon, meetings	35 75	
Binding (net), \$170.70 less \$39.50	131 20	
Insurance	31 14	
Periodicals	159 25	
Annual meeting	163 75	
Social Activities (net), \$446.06 less \$246.33	199 73	
Engineering Societies of Boston	4,535 00	
Designers Section	60 68	
Sanitary Section	104 74	
Highway Section	19 67	
Northeastern University Section	29 85	
Prizes	13 50	
Library (including salary of Librarian)	142 13	
Badges (net), \$111 less \$105	6 00	
Board of Reference	49 99	
Balance March 1, 1931	2,244 24	
		\$14,794 09

Permanent Fund

Receipts

Balance March 1, 1930	\$1,552 55	
Interest received (net), \$1,297.50 less \$10	1,287 50	
Entrance fees	310 00	
American Tel. & Tel. Co., rights sold	76 40	
Economy Light & Power Co., bond sold	1,100 00	
		\$4,326 45

Expenditures

American Tel. & Tel. Co., stock purchased	\$1,100 40	
Co-operative Banks (net), \$960 less \$632.40	327 60	
Income transferred to Current Fund	2,647 16	
Balance March 1, 1931	251 29	
		\$4,326 45

Edmund K. Turner Fund

Receipts

Balance March 1, 1930	\$25 62	
Received interest on bond	50 00	
		\$75 62

Expenditures

Books purchased	\$61 45	
Balance March 1, 1931	14 17	
		\$75 62

John R. Freeman Fund**PRINCIPAL***Receipts*

Commonwealth & Southern Corp., $\frac{1}{8}$ share warrant sold	\$28 13	
Commonwealth & Southern Corp., optional warrant sold	1 98	
Southwestern Power & Light Co., stock called	1,150 00	
		\$1,180 11

Expenditures

Deficit March 1, 1930	\$318 86	
Southern Calif. Edison Co., right purchased	5 00	
Southern Calif. Edison Co., com., 5 shares purchased	125 00	
Pacific Gas & Elec. Co., com., 2 rights purchased	5 25	
Montreal Light, Heat & Power Co., com., three payments on subscription for 6 shares	226 30	
Balance March 1, 1931	499 70	
		\$1,180 11

INTEREST*Receipts*

Balance March 1, 1930	\$1,904 81	
Dividends and interest received	1,692 78	
		\$3,597 59

Expenditures

Traveling scholarships	\$1,756 26	
Transferred to JOURNAL	1,000 00	
Balance March 1, 1931	841 33	
		\$3,597 59

Desmond FitzGerald Fund*Receipts*

Balance March 1, 1930	\$212 16	
Interest on bonds	100 00	
		\$312 16

Expenditures

Scholarship in Northeastern University	\$100 00	
Balance March 1, 1931	212 16	
		\$312 16

Alexis H. French Fund

Received and deposited in The Boston Five Cents Savings Bank	\$1,000 00	
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Clemens Herschel Fund

Received and deposited in the Charlestown Five Cents Savings Bank	\$1,000 00	
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TABLE 2. — COMPARATIVE BALANCE SHEET

	March 1, 1928	March 1, 1929	March 1, 1930	March 1, 1931
<i>Assets</i>				
Cash	\$4,673 70	\$4,397 54	\$4,387 92	\$4,062 89
Bonds	32,007 50	26,065 00	21,935 00	20,337 50
Stock	28,892 35	29,094 88	29,743 40	30,726 34
Co-operative banks	15,210 75	16,328 60	18,240 95	19,612 10
Savings bank	—	3,087 80	6,244 08	8,560 19
Library	7,500 00	7,500 00	7,500 00	7,500 00
Furniture	2,405 11	2,405 11	2,405 11	2,405 11
	\$90,689 41	\$88,878 93	\$90,456 46	\$93,204 13
<i>Liabilities</i>				
Permanent Fund	\$49,348 76	\$47,875 87	\$48,688 37	\$49,108 37
E. K. Turner Fund	1,042 10	1,018 92	1,019 37	1,007 92
Current Funds	60 79	489 08	1,011 64	2,244 24
J. R. Freeman Fund	28,437 07	27,472 79	27,614 81	26,721 33
D. FitzGerald Fund	2,017 16	2,117 16	2,217 16	2,217 16
Alexis H. French	—	—	—	1,000 00
Clemens Herschel	—	—	—	1,000 00
Surplus	9,905 11	9,905 11	9,905 11	9,905 11
	\$90,689 41	\$88,878 93	\$90,456 46	\$93,204 13

TABLE 3. — INVESTMENT OF FUNDS, MARCH 1, 1931

PERMANENT FUND

	Par Value	Book Value	Market Value
Bonds			
Union Elec. Light & Power Co. 5 $\frac{1}{2}$ %, 1932 .	\$2,000 00	\$2,050 00	\$2,040 00
Blackstone Valley Gas & Elec. 5 $\frac{1}{2}$ %, 1939 .	2,000 00	1,995 00	2,040 00
Superior Water, Light & Power Co. 4 $\frac{1}{2}$ %, 1931 .	4,000 00	3,347 50	3,980 00
Wheeling Electric Co. 5 $\frac{1}{2}$ %, 1941 .	4,000 00	3,845 00	4,040 00
Tampa Electric Co. 5%, 1933 .	2,000 00	2,000 00	1,980 00
Chicago & Northwestern Ry. 5 $\frac{1}{2}$ %, 1937 .	1,000 00	1,102 50	1,017 50
Public Electric Light Co. 5 $\frac{1}{2}$ %, 1956 .	1,000 00	1,000 00	890 00
American Tel. & Tel. Co. 5%, 1946 .	1,000 00	993 75	1,070 00
Arkansas Water Co. 5%, 1956 .	1,000 00	1,005 00	960 00
	\$18,000 00	\$17,338 75	\$18,017 50
Stock			
46 shares Amer. Tel. & Tel. Co. .	4,600 00	5,346 04	9,016 00
Total securities	\$22,600 00	\$22,684 79	\$27,033 50
Co-operative Banks			
40 shares Merchants Co-operative Bank, in- cluding interest to March		3,035 30	
40 shares Volunteer Co-operative Bank, in- cluding interest to January		5,195 20	
10 matured shares Merchants Co-operative Bank		2,000 00	
10 matured shares Volunteer Co-operative Bank		2,000 00	
40 shares Watertown Co-operative Bank, in- cluding interest to September		7,381 60	
Lynn Five Cents Savings Bank		3,408 31	
Eliot Savings Bank		3,151 88	
Cash		251 29	
Total value of Permanent Fund		\$49,108 37	

EDMUND K. TURNER FUND

	Par	Book Value	Market Value
American Tel. & Tel. Co. 5%, 1946	\$1,000 00	\$993 75	\$1,070 00
Cash on hand	—	14 17	—
Total	—	\$1,007 92	—

JOHN R. FREEMAN FUND

	Book Value	Market Value
10 shares New England Power Co. pf. 6%	\$960 00	\$1,100 00
10 shares New England Power Assoc. pf. 6%	970 00	845 00
8 shares Commonwealth & Southern Corp. pf. 6%	1,019 89	784 00
25 shares Commonwealth & Southern com. 60 cents		275 00
12 shares Commonwealth & Southern, option to purchase		
10 shares Carolina Power & Light Co. 7%	1,020 00	1,090 00
20 shares Amer. Super. Power Corp. pf. 6%	1,940 00	1,900 00
14 shares Georgia Power Co. pf. 6%	1,143 33	1,393 00
10 shares Alabama Power Co. pf. 7%	980 00	1,135 00
10 shares Electric Power & Light Co. pf. 7%	1,000 00	1,050 00
5 shares Electric Power & Light Co. com. \$100		285 00
10 shares Tenn. Electric Power Co. pf. 7%	950 00	1,070 00
10 shares West Penn. Power Co. pf. 7%	1,030 00	1,150 00
10 shares Minn. Power & Light Co. pf. 7%	980 00	1,050 00
10 shares Miss. River Power Co. pf. 6%	900 00	1,070 00
10 shares Utah Power & Light Co. pf. 7%	990 00	1,065 00
40 shares Pacific Gas & Electric Co. pf. 6%	932 02	1,100 00
58 shares Pacific Gas & Electric Co. com. 8%	1,658 79	2,958 00
10 shares Great Western Power Co. pf. 7%	990 00	1,030 00
40 shares Southern Calif. Edison Co. pf. 8%	1,161 22	2,320 00
14 shares Southern Calif. Edison Co. com. 8%	373 75	721 00
10 shares Northwestern Elec. Co. pf. 7%	980 00	950 00
10 shares Consumers Power Co. pf. 6%	1,020 00	1,040 00
30 shares Montreal Light, Heat & Power Co. com. \$2	1,200 00	1,582 50
30 shares Penn. Gas & Electric Light Co. pf. 7%	2,955 00	2,700 00
6 shares Montreal Light, Heat & Power Co. com. (3 pay- ments made)	226 30	226 30
Cash principal	\$25,380 30 499 70	\$29,889 80 —
Accumulated interest	\$25,880 00 841 33	— —
Total	\$26,721 33	—

DESMOND FITZGERALD FUND

	Par	Book Value	Market Value
Bonds			
Southwestern Gas & Electric Co. 5%, 1957 .	\$1,000 00	\$1,000 00	\$940 00
Central Power & Light Co. 5%, 1956 .	1,000 00	1,005 00	940 25
	—	\$2,005 00	\$1,880 25
Cash on hand	—	212 16	—
Total	—	\$2,217 16	—

ALEXIS H. FRENCH FUND

Boston Five Cents Savings Bank \$1,000 00

CLEMENS HERSCHEL FUND

Charlestown Five Cents Savings Bank \$1,000 00

REPORT OF AUDITING COMMITTEE FOR THE YEAR 1930-31

MARCH 14, 1931.

We have examined the accounts of the Treasurer of the Boston Society of Civil Engineers and find the books properly kept and the various expenditures of the past year supported by duly approved receipts.

The Treasurer has also accounted to us for the investments and cash on hand, as submitted by the above reports.

ARTHUR L. SHAW,
JOHN B. BABCOCK, 3d,

*Auditing Committee of the Directors of the
Boston Society of Civil Engineers.*

COMPARISON OF ESTIMATED AND ACTUAL EXPENDITURES, 1930-31

<i>Office:</i>	Estimated Expenditures	Actual Expenditures	
Salaries (except Editor)	\$325 00	\$300 00	
Insurance and Treasurer's bond	35 00	31 14	
Stationery, printing and postage	360 00	246 61	
Incidentals	100 00	205 05	
Periodicals and binding	360 00	280 45	
Library	300 00	142 13	
Prizes	40 00	13 50	
Board of Reference	—	49 99	
Total	—	\$1,520 00	\$1,278 87
<i>Meetings:</i>			
Rent	\$220 00	\$235 10	
Stereopticon and reporting	100 00	96 25	
Printing and postage (net)	350 00	285 84	
Social activities (net)	400 00	199 73	
Annual meeting, 1930	175 00	163 75	
Total	—	1,245 00	980 67
<i>Journal:</i>			
Editor's salary and expense	\$500 00	\$478 50	
Printing and postage	3,300 00	4,728 94	
Reprints (net)	100 00	32 50	
Total	—	3,900 00	5,239 94
Sections	—	300 00	214 94
Dues to Engineering Societies of Boston	—	4,535 00	4,535 00
Total	—	\$11,500 00	\$12,249 42
Transferred from Freeman Fund (JOURNAL for September), deducted	—	—	1,000 00
Net total expenditures	—	—	\$11,249 42

REPORT OF AUDITING COMMITTEE FOR YEAR 1930-31

BOSTON, March 14, 1931.

We have examined the records and accounts of the Secretary of the Boston Society of Civil Engineers and have satisfied ourselves that they are properly kept, and that the money received has been transferred to the Treasurer.

ARTHUR L. SHAW,
JOHN B. BABCOCK, 3d,

*Auditing Committee of the Directors of the
Boston Society of Civil Engineers.*

Report of the Editor

BOSTON, January 20, 1931.

To the Board of Government, Boston Society of Civil Engineers:

The Editor submits the following report for the calendar year 1930 (Volume XVII of the JOURNAL).

During the year 1930 there have been published twelve papers, eighteen items "of general interest" and two memoirs of deceased members.

The ten issues of the JOURNAL contained 723 pages; an average of 1,513 copies of each issue were printed. The net cost was \$3,812.86, as compared with \$2,854.17 for the preceding year. Table 1 includes a comparison of costs for the JOURNAL from 1926 to 1930, inclusive. In Table 2 details of cost for Volume XVII of the JOURNAL for the calendar year 1930 are shown.

The advertising in the pages of the JOURNAL while not showing an increase in total pages for these twelve months contains a large number of new advertisers. The advertising rates have been doubled during this period, beginning with the June issue, so that the book value of advertising has increased nearly 100 per cent over the previous year. The actual receipts for this twelve months' period do not show a corresponding increase because most of the payments are to be received subsequent to December.

Through the interest of Mr. John R. Freeman there was received from the John R. Freeman Fund a gift of \$1,000 toward the cost of publishing the September JOURNAL which contained the report of the Committee on Flood Control.

The December issue of each volume contains the Contents and Index for the year.

Respectfully submitted,

EVERETT N. HUTCHINS, *Editor.*

TABLE 1. — COMPARISON OF COSTS OF JOURNAL, 1926 TO 1930, INCLUSIVE

YEAR	Vol.	Number of Pages*	GROSS COST†		NET COST‡		Number of Cuts and Inserts
			Total	Per Page	Total	Per Page	
1926	XIII	606	\$4,045 13	\$6 68	\$2,652 71	\$4 38	132
1927	XIV	700	4,155 56	5 94	2,905 31	4 15	121
1928	XV	638	4,143 38	6 49	2,554 11	4 00	150
1929	XVI	641	4,525 79	7 06	2,854 17	4 45	116
1930	XVII	723	5,107 16	7 06	3,812 86	5 27	167

* Includes Advertising Section and Annual Index.

† Gross cost includes editing, printing, mailing and reprints.

‡ Net cost equals gross cost less amounts received for advertising, subscriptions and sale of JOURNALS.

Report of the Library Committee, 1930-31

BOSTON, MASS., March 18, 1931.

To the Boston Society of Civil Engineers:

The Chairman submits, for the Library Committee, the following report for the year 1930-31:

During the year 311 books have been loaned to members of the Society, or to members of other societies included in the Engineers Societies of Boston; and fines amounting to \$13.15 have been collected.

The following books have been contributed to the Library: "Brick Engineering, Vol. 1," Major L. B. Lent; "Structural Theory and Design," Sutherland and Bowman. The following books have been received from the library of Clemens Herschel as referred to in the last year's report of this committee:

The Submerged Weir as a Measuring Device, by G. N. Cox.
 Leonardo da Vinci, by J. W. Lieb.
 Leonardo da Vinci, Bibliography of, by J. W. Lieb.
 Leonardo da Vinci, reprint from Scribner's, January, 1879.
 Leonardo da Vinci, Miscellaneous papers in German, by Th. Beck.
 Leonardo da Vinci, by Hermann Grothe.
 Essay on Leonardo da Vinci (French), by J. B. Venturi, 1797.
 L'Aqueduc Romain, by Paul de Gasparin.
 Fluid Meters, Part 1, A. S. M. E., Special Committee 1924.
 River Discharge Measurements, by E. B. H. Wade.
 Storage Reservoirs, by A. Jacob.
 Experimental Hydraulics, by J. Weisbach.
 Figure of the Earth, by M. Merriman, 1881.
 Sundry Papers of Lowell Corporation.
 Discharge of Pipes, by A. D. Butcher.
 Essay on Probabilities, by La Place.
 Sundry Papers on Boston Harbor.
 Hydraulic Researches, Darcy and Bazin.
 Original Lecture Notes (long hand) of Clemens Herschel while at Carlsruhe, Vol. 1, 1861-62.
 Original Lecture Notes, Vol. 2, 1862-64.
 Conveyance and Distribution of Water, by Wegmann.
 North Sea Canal, by United States Engineers.
 Historical Notes (German), by Th. Beck.
 Quaker Bridge Dam, 1889, by B. S. Church.
 History of Cincinnati Water Works, 1909, by G. H. Benzenberg.
 United States Census, 1880, Water Power, Part 1.
 U. S. Census, 1880, Water Power, Part 2.
 Purification of Sewage and Water, Massachusetts State Board of Health.
 German and English Dictionary, by Thieme.
 History of Theory of Probability, by Todhunter.

The Committee has held several meetings during the year, at which the following matters have been discussed: (a) final disposition of books in dead storage; (b) miscellaneous books received from Clemens Herschel Library; (c) necessity for bringing up to date the files of reference books, handbooks and directories; (d) disposal of certain governmental reports.

The books in dead storage, a list of which was published and sent to the membership a year ago, are to be donated to the Baker Library of Harvard University. The books from the Herschel Library are listed above.

In order to provide additional space on the Library shelves, the Library Committee recommends to the Board of Government that the following list of books be removed from the shelves and disposed of by the Committee:

United States Department of Agriculture:	
Miscellaneous bulletins and circulars	1 shelf
Bureau of Soils	$\frac{3}{4}$ shelf
United States Censuses	4 shelves
Miscellaneous Reports, Financial Statistics	1 shelf
Navigation Congresses	1 shelf
Transactions, 15th International Congress, 1912	$\frac{1}{2}$ shelf
International Engineering Congress, 1915	$\frac{1}{2}$ shelf
Paris Exposition, 1890	$\frac{1}{2}$ shelf
Royal Committee on London Traffic	$\frac{1}{2}$ shelf
Metropolitan Water Works Contracts	1 shelf
New York v. New Jersey Passaic Valley Sewerage Case, 1916	$\frac{1}{2}$ shelf

The Committee recommends that the Board of Government adopt as a policy that State reports originating outside of Massachusetts, except those of exceptional or specific interest, be not incorporated hereafter in the Library.

The Committee has examined the list of reference and handbooks, and has replaced earlier editions with the latest edition of these books to the extent of this year's appropriation. The list of accessions is appended to this report.

Respectfully submitted,

HENRY B. ALVORD,
Librarian and Chairman,
Library Committee.

BOOKS ADDED TO THE LIBRARY, 1930-31

American Civil Engineers' Handbook, 1930. Merriman and Wiggins.
 American Railway Engineering Association, Manual of, 1929.
 Building Estimator's Handbook, 1930. Arthur.
 Estimating Building Costs, 1927. Barnes.
 Architects' and Builders' Handbook. Kidder and Nolan.
 Building Construction, Handbook of, Vol. 1. Hool and Johnson.
 Building Construction, Handbook of, Vol. 2. Hool and Johnson.
 Structural Engineers Handbook. Ketchum.
 Mechanical Engineers Handbook. Marks.
 Municipal Index. American City Magazine Corporation.
 Route Surveying. Pickels and Wiley.
 Wind Bracing. Spur.
 Brick Engineering, Vol. 1. L. B. Lent.
 Structural Theory and Design. Sutherland and Bowman.
 Books from Herschel Library, as listed in the body of the preceding report.

Report of the Committee on Social Activities

Boston, March 18, 1931.

To the Boston Society of Civil Engineers:

The Committee on Social Activities submits the following report for the year 1930-31.

At four out of eight meetings held during the past year the committee has served approximately 530 members and guests of the Society with buffet suppers, an average of 133 per meeting, or 8 more than the average of last year.

In January, when a joint meeting with the Boston Section of the American Welding Society was held, 138 members and guests were served, and at the February meeting, which was the occasion of the annual Student Night, 260 hungry members and guests were fed with tasty chicken pies and what usually goes with them.

The smallest number served at any meeting was 58 members and guests.

Buffet suppers were not served at the other four meetings, owing to the fact that these were held in the Chamber of Commerce Building, in the basement of which is a good cafeteria, where those members and guests, who cared to do so, dined together in a reserved section before the meeting. The average per meeting dining there was 52.

From a social standpoint we feel that these suppers at the cafeteria were not quite as enjoyable because the small tables permitted only four to sit together, and did not allow for the usual informal moving about which we are accustomed to in Chipman Hall.

Following the custom now well established, the June meeting was omitted in favor of the annual joint outing with the New England Water Works Association, which took place this year at Hotel Pilgrim in Plymouth. About 150 members of the societies, ladies and guests attended it.

The charge this year for buffet suppers has been 50 cents to all. We do not feel that this has exerted undue pressure on the individual pocketbook, and we know that the Society has fared better. The actual cost of these suppers has been somewhat in excess of 50 cents per plate.

In the hope that the members and their guests have been satisfied with their treatment by the Social Activities Committee, and that, if not, they will suggest how it may be improved, this report is concluded.

Respectfully submitted,

RICHARD W. SHERMAN, *Chairman.*

Report of the Committee on Subsoils

The Committee on Subsoils presented at the annual meeting of the Society a summary report on the great amount of valuable data which have been assembled during a period of several years. It was accompanied by the complete records concerning hundreds of borings made in Boston, together with several plans showing locations of these many borings. It is expected that this report will be printed in a later issue of the JOURNAL.

The committee consisted of Harry E. Sawtell, Chairman, Irving B. Crosby, Heywood S. French, Charles D. Kirkpatrick, Charles W. Robinson and Albert C. Titcomb.

Report of Executive Committee of the Sanitary Section

BOSTON, March 11, 1931.

To the Sanitary Section, Boston Society of Civil Engineers:

There have been four meetings and one excursion held during the year, as follows:

March 5, 1930. — Annual meeting. "Industrial Sanitation," by Theodore F. Hatch of Harvard University (illustrated); *attendance, 32.*

May 7, 1930. — Special meeting. Symposium on the subject, "Actually, Now, Are Pigs Pigs?" by Messrs. Edward Wright, Francis H. Kingsbury, George C. Houser, Frank L. Flood and Prof. Gordon M. Fair, all members of this Section, and Mr. Potter of Lexington (illustrated); *attendance, 26.*

September 26, 1930. — Excursion. Neponset Valley Sewer. Conducted by Messrs. Ralph W. Loud and Seth Peterson of the Metropolitan District Commission; *attendance, 36.*

December 3, 1930. — Regular meeting. "Collection and Disposal of Municipal Refuse at Rochester, N. Y.," by Mr. Harold W. Baker, Commissioner of Public Works of that city (illustrated); *attendance, 56.*

February 4, 1931. — Special meeting. "The Trials and Tribulations of a Sanitary Engineer Witness," by Mr. E. Sherman Chase of Metcalf & Eddy; *attendance, 22.*

Attendance. — Attendance at meetings has varied from 22 to 56, and has averaged 34.

The practice of meeting to dine prior to the meetings has been continued, the attendance varying from 15 to 29, and averaging 21.

Membership. — The present membership of the Section is 191, a loss of 6 since last year.

Four new members have been added to our membership, while 10 have been lost, — 4 by resignation, 2 by forfeiture, and 4 by death. The names of the members who have been taken from us by death are: Allen Hazen, D. W. Pratt, W. L. Vennard and J. E. Titus.

Executive Committee Meetings. — The executive committee has held six meetings during the year.

Respectfully submitted,

For the Executive Committee,

GEORGE G. BOGREN, *Clerk.*

Report of the Executive Committee of the Designers Section

BOSTON, March 11, 1931.

To the Designers Section, Boston Society of Civil Engineers:

During the past year eight regular meetings of the Section have been held, as follows:

March 12, 1930. — *Subject*, "The Circle of Stress;" *speaker*, Prof. L. J. Johnson of Harvard University; *attendance*, 22.

April 9, 1930. — *Subject*, "The Separate Effects of Shears and Moments on Rigid Frame Bents;" *speaker*, Prof. T. H. Frost of Massachusetts Institute of Technology; *attendance*, 23.

May 14, 1930. — *Subject*, "The Analysis of Continuous Beams and Rigid Frames by Cross Method of Moment Distribution;" *speaker*, Prof. Hale Sutherland of Massachusetts Institute of Technology; *attendance*, 45.

October 8, 1930. — *Subject*, "High Buildings in Boston;" *speakers*, Mr. Maurice A. Reidy, Structural Engineer of Boston, Mr. D. W. Clapp of Blackall, Clapp and Whittemore, Architects; *attendance*, 38.

November 12, 1930. — *Subject*, "Fire Protection of Structural Members;" *speaker*, Mr. C. K. Stiff, Engineer, Associated Factory Mutual Fire Insurance Companies; *attendance*, 18.

December 10, 1930. — *Subject*, "Deformation of Concrete under Setting and Temperature Changes;" *speaker*, Mr. W. M. Bassett, Engineer of Structures, New England Power Construction Company; *attendance*, 51.

January 14, 1931. — *Subject*, "Columns subjected to Eccentric and Transverse Loading;" *speaker*, Mr. Kimball R. Garland, Structural Designer with Mark Linenthal, Engineer, of Boston; *attendance*, 37.

February 12, 1931. — *Subject*, "The Angular Rotation Method for the Analysis of Multiple Span Frames;" *speaker*, Mr. Raymond A. Freeman of Jackson & Moreland, Engineers, of Boston, as co-author with Alexander S. Gelman, with Gibbs & Hill, New York; *attendance*, 37.

The average attendance during the past year was 34.

During the year 11 new members were added, 4 resigned and 4 were forfeited, leaving a net membership of 173. The membership in March, 1930, was 170.

Respectfully submitted,

For the Executive Committee,

LAWRENCE G. ROPES, *Clerk*.

Report of the Executive Committee of the Highway Section

BOSTON, March 11, 1931.

To the Highway Section, Boston Society of Civil Engineers:

During the past year four regular meetings of the Highway Section have been held. These meetings are summarized as follows:

February 26, 1930. — Annual meeting. Election of officers, as follows: Chairman, James E. Lawrence; Vice-Chairman, James W. Ingalls; Clerk, Ernest Mathers; Executive Committee, A. B. Edwards, Francis T. McAvoy, Edwin H. Rogers. *Speaker*,

Mr. James H. Taylor, Landscape Engineer of Massachusetts Department of Public Works; *Subject*, "Highway Beautification;" *attendance*, 20.

May 28, 1930. — *Speaker*, Col. H. L. Bowlby, General Manager of Flintkote Roads, Inc., New York; *Subject*, "Bituminous Emulsions and Cold Asphalt Road Emulsions;" *attendance*, 40.

October 4, 1930. — Inspection Trip to the Exhibit of the Department of Public Works, in connection with the Exhibit of the Activities of Various State Departments, in the Commonwealth Armory; *attendance*, 15.

November 25, 1930. — *Speaker*, Mr. Philip Ayers, Secretary of the Society for the Protection of Forests in New Hampshire; *Subject*, "The Engineer and the Beauty of the Highway;" *attendance*, 14.

During the year the Executive Committee has held four meetings.

Membership. — The present membership in the Highway Section is 93; during the year there have been 8 new members enrolled. Two have forfeited membership, two have resigned, and four have died, namely, J. V. Corbett, W. H. Cronin, C. A. Mason and W. L. Vennard.

Attendance. — The attendance at meetings during the year has ranged from 14 to 40, and has averaged 22 per meeting.

Respectfully submitted,

For the Executive Committee,

ERNEST MATHERS, *Clerk*.

Report of the Executive Committee of the Northeastern University Section

MARCH, 11, 1931.

To the Northeastern University Section, Boston Society of Civil Engineers:

The Northeastern University Section of the Boston Society of Civil Engineers has held six meetings during the year.

March 28, 1930. — An excursion to inspect the construction of the extension of the Lynn Fells Parkway in Melrose and Saugus.

May 16, 1930. — Annual Meeting. "The Engineer," by Lewis E. Moore, President of the Boston Society of Civil Engineers.

October 3, 1930. — "International Road Builders," by Van Ness Bates of the Warren Brothers Company.

December 11, 1930. — "Two Methods of Reducing Geographic Positions to Rectangular Co-ordinates," by Prof. Henry B. Alvord.

January 9, 1931. — "Twin Ignition Engineering," by Albert O. Wilson, President of the A. O. Wilson Structural Company.

February 24, 1931. — "Automotive Traffic Despatching Systems," by O. M. Jacobi, Electrical Engineer, Automatic Signal Corporation.

BOSTON SOCIETY OF CIVIL ENGINEERS

FOUNDED 1848

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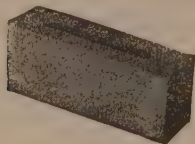
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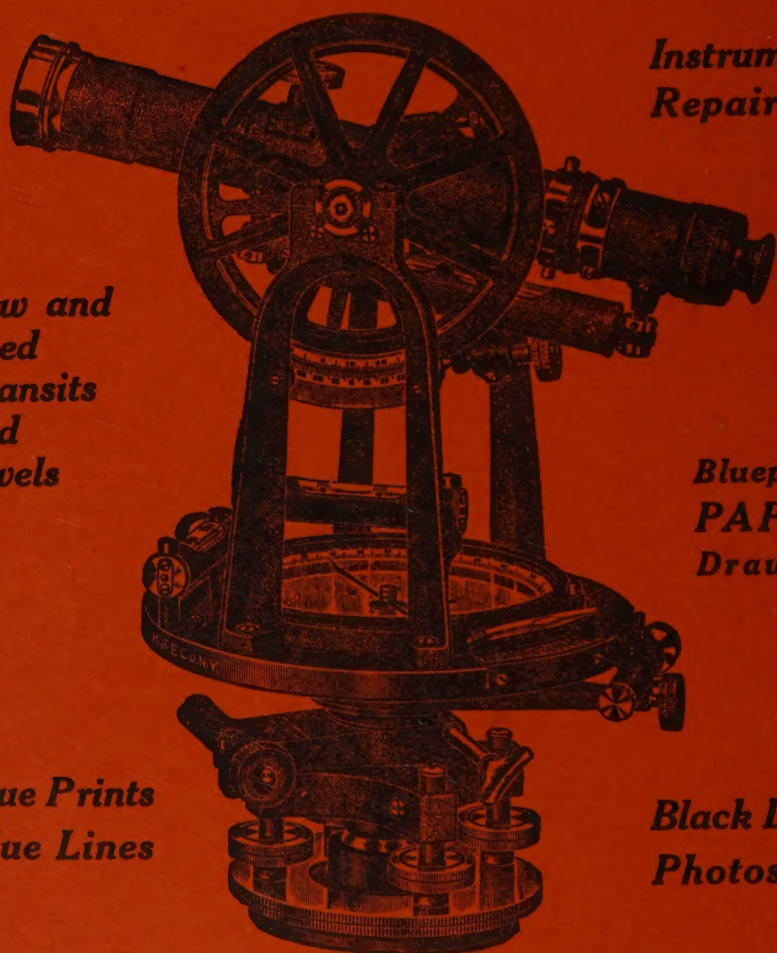
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